Organising Knowledge Sharing in a Dispersed Organisation: A Socio-technical Perspective

by

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ABBREVIATIONS

Buckman Labs	Buckman Laboratories
CAD	Computer-aided Design
CBT	Computer-based Technologies
CIC	Customer Information Centre
HRD	Human Resource Development
HRM	Human Resource Management
ICT	Information and Communication Technology
IS	Information Systems
KAM	K'Netix Access Menu
KM	Knowledge Management
KMS	Knowledge Management Systems
KNA	K'Netix Network Architecture
KRC	Knowledge Resource Centre
KTD	Knowledge Technology Department
KTS	Knowledge Transfer System
LAN	Local Area Networks
MIDAS	Marketing Information Data Analysis System
R&D	Research and Development
TIC	Technology Information Centre

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Undertaking a research for a thesis or dissertation is an experience that most people never forget. Worries about what topic to investigate, how to go about doing research, how to work with supervisors, finding a job after graduation and the list of worries goes on.

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DECLARATION

This dissertation is presented in accordance with the regulations for the degree of doctor of philosophy. The work described in this dissertation is entirely original and my own, unless otherwise indicated. The author also confirms that this dissertation has not been submitted for a degree at another university. The interpretations in this dissertation are the sole responsibility of the author, and in no way represent the views of the case study organisation, nor of Warwick Business School.

The following papers arising from work on the thesis had been published before submission:

Journal Paper

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Book Chapter

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ABSTRACT

Knowledge has been identified as one of the most important resources that contribute to the competitive advantage of an organisation. The organisational and social issues associated with the development, implementation and use of information technology have increasingly attracted the attention of knowledge management researchers. This study is based on an empirical investigation of knowledge sharing processes from a dispersed international organisation, Buckman Laboratories.

Through a socio-technical perspective, this research traces the interactions between knowledge sharing practices and the organisational context. The conditions surrounding the organisation of knowledge sharing as an organisational practice are addressed in the case presented in the dissertation. In particular, the research has closely examined knowledge management initiatives during the period of 1992-1998 implemented by Buckman Laboratories, focusing on the issues of organising knowledge sharing processes. The research traces Buckman Laboratories' experience as a networked, global company organised as a set of linked knowledge-focused communities of practice.

Based on the findings of a case study of one unique knowledge-intensive organisation, the research presents a model of organising knowledge sharing. It develops a socio-technical perspective to grounded field data and suggests that the experience of this organisation can be considered as a particular form of knowledge management – one that utilises various mechanisms for leveraging knowledge sharing towards sustainable competitive advantage. The study concludes that enabling, integrating and co-ordinating mechanisms play a critical role in establishing the multi-level context for the effective assimilation of knowledge sharing practice.

1 Chapter One: Introduction

1.1 Introduction

There is now widespread agreement that knowledge is one of the most important resources that contributes to the competitive advantage of an organisation (Grant, 1996a). The organisational and social issues associated with the development, implementation and use of information technology have increasingly attracted the attention of knowledge management (KM) researchers. At the same time, there has been a growing recognition that new organisational techniques and tools are needed to manage knowledge assets (Offsey, 1997), and that knowledge sharing is a core organisational competence (Newman, 1997). Unfortunately, few previous KM studies have observed, assessed and analysed the interplay between knowledge-sharing activities and organisational elements from an integrative perspective. This study seeks to fill this gap by highlighting the interplay between organisational processes and the organisation of knowledge sharing over time.

Specifically, this study deals with the last of the three conceptual barriers suggested by Miles *et al* (1998) with regards to KM research: conceptualising knowledge as the central organisational asset, incorporating knowledge capital into the strategic management process, and designing organisations to facilitate knowledge utilisation. The underlying aim is to gain insights into the mechanisms and processes of organising knowledge sharing in a dispersed organisation by

exploring the development of the trajectory over time. In particular, this research is concerned with the roles of management processes in facilitating a supportive social environment and the adoption of information and communication technologies (ICT) based systems. To this end, an in-depth case study of a knowledge-intensive organisation was conducted to gain much needed empirical evidence relating to KM (Leidner, 1999). The selected organisation provided an excellent focus of study because it had experience of over seven years of organisational change and development involving organisational knowledge-sharing efforts.

1.2 Background to the Research

Since the early 1990s, there has been an increasing emphasis on strategic issues related to the so-called knowledge-based economy (Quinn, 1992; Drucker, 1993; Nonaka, 1991). This has led to the recognition of knowledge as one of the most important resources that contributes to the competitive advantage of an organisation (Grant, 1996; Drucker, 1993). It is claimed that, with product life-cycles shortening and technologies becoming increasingly imitable, organisational knowledge has emerged as a major source of competitive advantage by virtue of its tacitness, inimitability and immobility (Grant, 1997). In other words, in today's turbulent international business environment, firms no longer compete only by exploiting global scale economies or arbitrating imperfections in production factors such as labour, materials, or capital markets. Rather, with a powerful new class of

technical scientific experts emerging (Galbraith, 1977), knowledge has become the key production factor that organisations need to exploit in order gain competitive advantage and survive (Drucker, 1993). In particular, with major advancements in ICT, information and knowledge can be processed, stored and transmitted globally more efficiently and effectively than ever before (Webster, 1995). As a result, knowledge-based organisations are fast becoming the engines of economic growth as the industrial era gives way to the information age.

In this regard, technological changes, interactive learning, knowledge sharing, knowledge integration and other knowledge related activities have become the focal elements of many of the existing KM studies and practices (Grant, 1996; Fruin, 1997; Stewart, 1997; Sveiby, 1997). Indeed, performance differences across organisations may be attributed to asymmetries in knowledge. The strategic issues of organisational knowledge have increasingly attracted the attention of management researchers.

1.3 A Summary of Previous Research and the Research Gaps

In recent years, a number of management researchers have outlined the theoretical case for KM (Senge, 1990; Spender, 1996; Grant, 1996; Huber, 1991; Tsoukas 1996). Despite the plausibility of these arguments, however, relatively few studies have provided empirical insights into how companies actually develop and manage 'know-how' (Nonaka and Takeuchi, 1995; Leonard-Barton, 1992) through the

interplay between organisational context and information technology (Starbuck, 1992). Much of the existing literature is concerned with an ontological debate about the nature of knowledge and therefore tends to promote particular approaches as universal panaceas. In particular, some of the previous literature has treated KM in a positivistic way as though it were a purely 'objective' phenomenon (Grant, 1996). Similarly, many writers have attempted to define precisely what KM actually 'is' (Blackler, 1995; Tsoukas, 1994; Spender, 1996) and have often resorted to technological representations as universal solutions. These unintegrated efforts identified in the existing literature are, in terms of the theoretical development of KM, of limited value.

The above theoretical arguments are difficult to relate to the actual experience of business organisations. This is partly because the very quality of tacitness, which lends such importance to organisational knowledge, makes it an elusive item for practitioners. We also know comparatively little about the actual organisational processes through which knowledge is valorised in competitive outcomes (Scarbrough, 1998; Huber, 1991). At the same time, the absence of a framework for managing knowledge on a broad and relevant basis is becoming an increasingly critical problem for managers.

From this brief review, it is clear that previous studies have suffered from the following inadequacies. First, they regard knowledge as a kind of economic asset or commodity, and tend to ignore the process of organisational knowledge

transformation that is constructed socially as an organisation reflects on itself (Nicolini and Meznar, 1995). Secondly, as pointed out by Scarbrough *et al.* (1999), with the development of the field of KM, there has been a massive outpouring of articles and books dealing with these issues from a prescriptive standpoint. Their relatively weak empirical base notwithstanding, many of these contributions confidently define organisational knowledge as a purely cognitive phenomenon. Their emphasis is firmly upon the conversion of tacit knowledge into explicit knowledge through the use of information technology (Scarbrough *et al.*, 1999).

Thirdly, despite the plausibility of these previous KM arguments, relatively few studies have provided empirical insights into how companies actually develop and manage 'know-how' (Nonaka and Takeuchi, 1995; Leonard-Barton, 1995) through the analytical lens formed by the interplay between organisational context and information technology (Starbuck, 1992; Orlikowski, 1992). Fourthly, despite its progress, much of the existing KM literature is difficult to relate to the actual experience of business organisations. Fixing our gaze upon the mysteries of organisational knowledge not only risks overstating the effect of new information technologies and understating mundane organisational factors, but also leads to a static model of KM that is disconnected from changing business contexts. The overall effect of the theoretical approach presented here, therefore, is to bridge the gap between the abstract concepts that are employed to understand knowledge and the practical, context-dependent realities facing business organisations.

1.4 Research Objectives

Against this background, this inter-disciplinary study sets out to gain insights into how a knowledge-intensive organisation organises itself for intra-organisational knowledge sharing by exploring the trajectory of its strategic development over time. Buckman Labs provides an excellent setting for such a study since it has developed and implemented, since 1992, a formalised system of knowledge sharing taking into consideration the social and technical elements of such a process. Therefore, broadly speaking, a further objective of this study is to explore the interactions between knowledge-sharing practices and the use of ICT-based systems and their organisational implications. In other words, the study seeks to describe and explain how, from a holistic perspective, a knowledge-intensive organisation organises its knowledge sharing over time by using different facilitative mechanisms. In addition, by adopting a managerial standpoint, the study aims to approach knowledge sharing from a socio-technical perspective that highlights the interplay between organisational context and the ICT-based knowledge transfer tools developed by the case company. This orientation to knowledge sharing builds on some central themes and distinctions found in the substantial and expanding literature on knowledge and knowledge processes.

The present study argues that, as the focus of KM is shifting from the individual to the community, a holistic view of KM must be adopted (Spender, 1996; Starbuck, 1992). Therefore, the study argues that a set of relevant social groups

(communities of practice) have to be identified in order to trace the flow of knowledge, allocated resources and social relationships involved in knowledge-sharing activities. Thus, the focus is on multiple contextual factors, strategies, decision processes, administrative systems and outcomes.

Interestingly, the central debate of the research is not whether the tacit components of knowledge can be exchanged via electronic means. The present study draws on the above-mentioned theoretical insights to propose a study of organisational phenomena that is historically, processually and contextually connected. The aim is to document patterns within multiple contexts, between contexts and over time, and to provide explanations that ground the process through which knowledge sharing is organised and leveraged within a particular organisational work context. In so doing, the research seeks to produce an account of socio-technical processes that is rich in description and provides new conceptual lenses through which to observe important phenomena and challenge current beliefs (Chakravarthy and Doz, 1992). In the selected case study, the focus is on how a knowledge-intensive organisation effectively fostered knowledge sharing in period 1992-1998. In particular, two broad questions helped shaped the boundary of the enquiry: (1) Is it possible to create a balance between pull and push factors in organising knowledge through the enabling role of a socio-technical environment that nurtures and accelerates the expansion of organisational knowledge? If so, (2) what are the critical social, technical and managerial mechanisms and processes of such an environment that

makes it a very useful and desirable addition to the organisation?

1.5 Justification of the Research

In order to achieve the above-mentioned objectives, the research suggests that it is useful to develop a perspective for understanding existing knowledge-sharing capabilities rather than to conceptualise a prescribed model of culture (Nevis *et al.*, 1995). In particular, this empirical fieldwork-based study sets out to identify the organisation of knowledge sharing in a particular organisation and presents three mechanisms (enabling, integrating and co-ordinating) that reflect the organisational knowledge-sharing capability. Rather than developing a conceptual framework for knowledge-sharing archetypes which are then used normatively, the approach involves developing grounded mechanisms for organising knowledge sharing that may be used for descriptive purposes.

As a suitable case study of a pioneering organisation whose purpose is to facilitate knowledge sharing for competitive advantage, Buckman Labs has been selected. The company has already earned a reputation as a knowledge-intensive organisation (Zack, 1999b). In the subsequent analysis, the study develops a socio-technical model of the organisation of knowledge sharing that highlights the interplay between the organisational context and the knowledge sharing-tools developed at Buckman Labs - an interplay which had to be carefully guided and managed to achieve positive results.

In sum, in this study, organisational knowledge is perceived as a vital factor in generating sustainable competitive advantage in today's intensive knowledge-driven environment. In order to understand how competitive advantage is generated, the research first explores the processes and mechanisms used for organising knowledge sharing. Unpacking these processes provides a better understanding of the generation and management of knowledge sharing. That is, the research aims to integrate the organisational, social and technical dimensions of knowledge sharing in the study of Buckman Labs. These objectives point to the need for a broad, inter-disciplinary and pluralistic approach to organisational knowledge.

1.6 Research Questions and Methodology

Having identified a number of problems associated with the existing literature on knowledge sharing, the research attempts to frame research questions broad enough to support a longitudinal study and examine multiple sources of evidence. The research takes an empirical approach that is based on a detailed longitudinal case study of Buckman Labs. It develops a distinctive 'strategic process' (Pettigrew, 1997) perspective on knowledge sharing which arguably provides a more effective analysis of the tensions and opportunities involved in the organisation of knowledge sharing within a particular organisational environment.

Based on the research gaps identified in the literature review, two key research

questions are pursued through a combination of qualitative methods ranging from on-site observation to face-to-face interviews. These research questions are not prioritised and are drawn fairly widely so that the study can focus on areas developing useful information with the aim of reframing the research agenda. Specifically, the two research questions are:

- What are the mechanisms involved in organising knowledge-sharing activities over time?
- How are the mechanisms for organising knowledge sharing interrelated over time?

Although knowledge sharing can be notoriously difficult to measure, questions like these, vigorously pursued, should lead to concrete answers which can shed some light on the traditions, assumptions and habits that affect knowledge and technology strategy in knowledge-intensive organisations. These questions are addressed through a qualitative research process, built on a grounded theory approach. Essentially, this study argues that the task of organising knowledge sharing effectively involves more than investing in computerised systems. The research outlines the key processes of organising knowledge-sharing activities, and provides a new perspective on the interplay of the social and technological aspects of knowledge sharing.

1.7 Definitions of Terms

Previous studies have understood knowledge to be manipulated by

management's control and direction, knowledge residing cognitively in either the heads of knowledge workers or in a more codified form in the systems and technologies that they operate. Contrary to some of the previous attempts, in this research, knowledge is considered to be "abstracted both from the social context of its formation and from the active processes of knowing and sense-making which are the subjective expression of the individual's interactions within that context" (Scarbrough, 1997: 9). In other words, this study considers knowledge as embedded in conversations and social interactions within communities of practice as well as being a functional resource and commodity that is disseminated by the sender to the receiver using ICT. Moreover, knowledge also possesses a distributed and appropriated character as it is constantly emerging in dynamic social interactions within communities.

This study proposes a socio-technical perspective on the organisation of knowledge sharing by focusing upon the manifestation of tacit knowledge and the interdependency of tacit and explicit knowledge. In particular, the tacit knowledge and its embeddedness within particular social groupings such as communities of practice are highlighted. The adoption of a socio-technical perspective offers an alternative view of KM as a strategic asset within a socio-technical environment of communities of practice. Therefore, following Brown and Duguid (1991), KM is defined in this research as the knowledge activity facilitated by the interplay between the use of information technology and human elements within

communities of practice.

Moreover, while the potential advantages of an internal organisation over a market organisation arise from its superior abilities in both the exploration and exploitation of intellectual capital (Kogut and Zander, 1993), the research concentrates on the exploitation aspects. That is, it seeks to identify the mechanisms and processes adopted by the organisation in facilitating intra-organisational knowledge sharing. Two organisational features are especially important in this respect. On the one hand, part of the focus of the research is to understand the organisation of the social relationships in which knowledge is embedded, which necessitates an emphasis on the tacit dimension of knowledge and, in particular, its embeddedness or 'stickiness' within particular social groupings. On the other hand, the use of ICT-based knowledge management systems (KMS) is considered important in the process as most organisations are, or are becoming globalised. Thus, this study defines the organisation of knowledge sharing as a socially constructed process within communities of practice that largely pertains to the development and leveraging of tacit knowledge and explicit knowledge via the use of ICT-based systems.

1.8 Outline of the Thesis

The structure of the remaining parts of the thesis is based on guidelines proposed by Phillips and Pugh (1994), and may be summarised as follows.

Chapters 2, and 3 lay the theoretical and methodological foundation of the thesis. After an introduction in Chapter 1, Chapter 2 reviews the literature, setting out key theoretical and conceptual arguments within the framework or lens used for the collection and analytical processes of this study. It also considers some of the different approaches to managing knowledge as a basis for the subsequent analysis. It evaluates research in the areas of knowledge-based theories of the firm, organisational learning, cognition, the management of ICT (collaborative technologies), and the organisational, social and managerial aspects of KM.

Chapter 3 introduces the research methodology. It identifies the sociological and philosophical orientations of the research and develops a conceptual perspective that guides the empirical analysis. It explains and justifies the research approach and design, explains the research timetable and stages, and then deals in turn with the practical processes used in the data collection methods, with a discussion of the main methodological issues arising from each. General methodological issues, particularly those associated with interpretation, replicability and theoretical validation, are also discussed.

The empirical work undertaken in this thesis is described in Chapter 4. This chapter presents detailed findings from the Buckman Labs case. The main focus is the interpretation of the management implications related to the implementation of a unique KM practice. The chapter follows a predominantly chronological ordering of events and processes with a focus on the period 1992-1998. It presents an

interpretation and analysis of emerging themes around the two research questions.

A synthesis of key themes is presented in Chapter 5. It discusses the main findings, focusing on the mechanisms and processes of knowledge sharing, detected through this study's observation and analysis. These findings are based on the theoretical and philosophical assumptions discussed in Chapters 2 and 3. The discussion revolves around a consideration of the three key mechanisms identified: enabling, integrating and co-ordinating.

Finally, Chapter 6 concludes the discussion generated in the previous chapters. It summarises the main contributions of the research and identifies the major limitations of this study. The methodological problems experienced, and the theoretical concerns related to the advancement of the understanding of KM are underlined. Finally, future research directions are identified and discussed. Appendices are also included in the last section of the thesis to provide information on data sources, the list of interviewees and other organisational background.

1.9 Conclusion

This chapter has sought to introduce the aims and theoretical foundations of the dissertation. It has summarised the central research problem and the key research questions. It has justified the research, provided definitions of essential terms, described the methodology and outlined the structure of the thesis. A review of the

literature follows in the next chapter.

2 Chapter Two: Literature Review

2.1 Introduction

The focus of this research is on the trajectory of organising knowledge sharing in Buckman Labs over a period of seven years. While the current discussions on KM seem to suffer from a lack of inter-disciplinarity, this study aims to draw from various strands of KM studies. In the case study presented here, KM is defined very broadly, encompassing any processes and practices concerned with the creation, transfer, dissemination, sharing, use of knowledge, skills and experience (Quintas *et al*, 1997). The approach taken reflects recognition that, as KM is an emergent field drawing on many disciplines and literatures, any attempts to explore this phenomenon require a broader literature review covering different issues from various perspectives of KM. As a result, a broad literature review was conducted (taking into accounts some of the key issues raised in the eight different perspectives of KM). Based on the review, a socio-technical perspective of this study is then proposed to provide an analytical lens for exploring organising knowledge sharing in a particular organisation.

This means that there is potentially a voluminous literature to draw upon. Accordingly, it is necessary to place some limitations on the scope of the present literature review in order to make it manageable. Two key issues were acknowledged during the review process. Firstly, only one aspect of KM was

selected as the main focus of this KM study to provide this study a focal and anchor point amid different related KM issues. The term KM encompasses a very wide range of related activities, including knowledge sharing, knowledge creation (Nonaka, 1991) and knowledge transfer (Van Krogh and Roos, 1995). Therefore, it must be emphasised that the focus of the present research is on knowledge sharing, and it is in this more restricted sense that the term KM is employed in this study.

Secondly, the scope of the review was driven by the approach taken by the author. The purpose of this review is, rather than to offer a comprehensive review of the field, to highlight some common and shared characteristics of the KM literature which could help explain the complexities involved in organising knowledge sharing. As a result, the following review only highlights the idiosyncractic reading of this literature by the author, whose own preferences and prejudices stem from the belief that the concept of KM is best understood as multifaceted, multi-layered, context dependent and situated in a socio-technical environment.

Therefore, the present research stresses not only the content of KM concepts and approaches but also seeks to locate them in their wider context of debates about the organisation of work, the management of people, and the sources of wealth creation in contemporary society. These foci lead in turn to an interest in the notion of the knowledge economy, the emergence of knowledge as an important resource, cognition, the taxonomy of knowledge, the use of ICT, the strategic management of knowledge, and the measurement of intellectual capital. It is these plural and wide-ranging concerns which have informed the content and structure of this literature

review. Figure 2-1 summarises the various perspectives on KM to be reviewed and analysed here. These are divided into macro and micro views, which in total include eight different perspectives.

While each of these perspectives provides important insights into one aspect or another of KM, none is sufficient by itself to provide an integrating framework (Teece, 1998). Therefore, the intention of this review is to apply and integrate these multi-disciplinary perspectives to facilitate distinct theoretical contributions to an understanding of the task of organising knowledge sharing. To this end, some key concepts drawn from the various perspectives are brought together within an overall socio-technical framework.

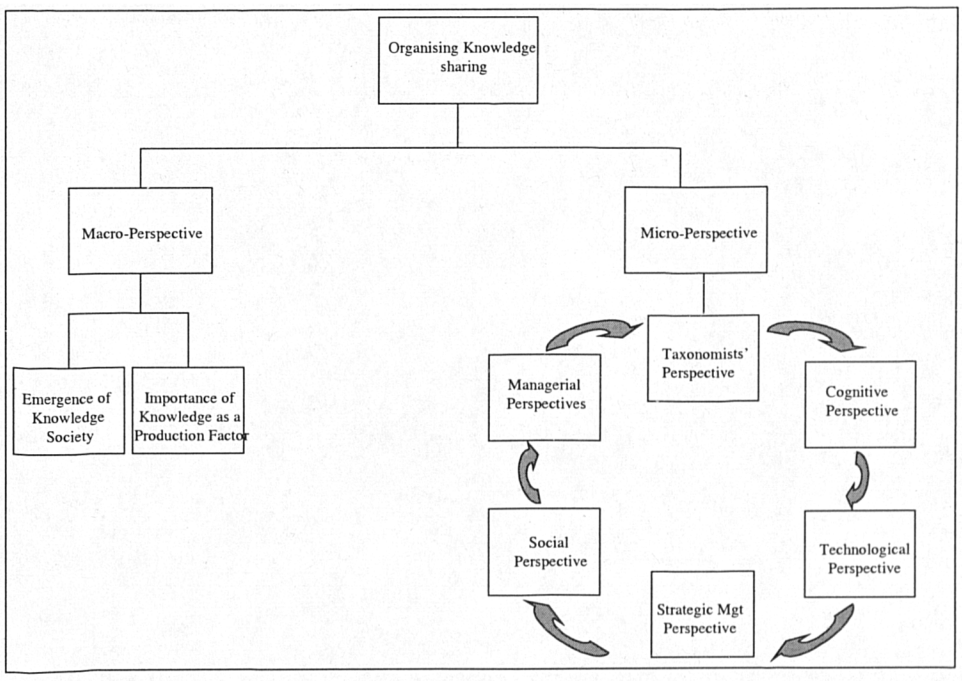

Figure 2-1: The theoretical boundaries of KM in this research

The literature review has five specific objectives:

- to establish the boundaries of KM studies
- to reveal the history of the development of organisational knowledge studies
- to offer a critical assessments of the literature
- to develop a critical intellectual perspective and identity via critical reflection and a synthesis of the extant literature
- to expose some common themes in the literature of KM

The rest of this chapter consists of five main sections. Section 2.2 outlines the wider macro and micro context for KM and its components. In this section, a review of existing perspectives on KM is provided. The growing gaps between various strands of the literature are also highlighted. In particular, the imbalance between the social and technical foci of KM research is highlighted. Section 2.3 examines an emergent view of KM that regards organising knowledge sharing as socially constructed as well as a functional resource residing within social interactions. In particular, it attempts to synthesise the various perspectives of KM by developing a socio-technical perspective for the present study. Section 2.4 presents an overall summary of this chapter's contribution.

2.2 A Review of the Related Literature

In the following discussion, macro issues relating to the emergence of knowledge and the knowledge society are first considered. Then micro issues, concerned with KM at an organisational level are also discussed.

2.2.1 A Macro-View of KM

2.2.1.1 The Emergence of the Knowledge Society

The starting-point for the macro view is the notion that we may have now entered the era of knowledge and are living and working in a knowledge society as knowledge workers (Drucker, 1994). Drucker (1992) argues that, in the emerging society of organisations, competitive firms can be seen as generators and transformers of different kinds of knowledge (von Tunzelmann, 1995). As firms increasingly compete with a different stock of knowledge (Arthur, 1990; Stinchcombe, 1990; von Krogh and Roos, 1995), the management of the firm's knowledge base has emerged as a major challenge for firms in maintaining sustainable competitive advantage (Spender, 1996).

The growth of 'knowledge work' has been remarkable, despite continuing efforts to reduce the size of the work force in the manufacturing and goods production sectors. At the global level, one possible reason for this transition is the increasing globalisation of firms (Neef, 1998) and related trends – deregulation, privatisation and increased customer sophistication – which have raised the standards for organisations competing in various industries (Quinn, 1992). Moreover,

technological and related organisational changes have also accelerated this trend in recent years (Zuboff, 1988).

One of the first authors to directly employ the term 'knowledgeable society' was Robert Lane (1966). His conception is closely tied to the premise of a particular theory of science, which advocates the possibility of a society in which common sense is replaced by scientific reasoning. Drucker (1969) also used the term 'knowledge society' thirty years ago. More recently, he has argued that "in this society, knowledge is the primary resource for individuals and for the economy overall. Land, labour, capital – the economist's traditional factors of production – do not disappear, but they become secondary" (Drucker, 1992: 95). However, according to Stehr (1994), although Drucker's pioneering work on knowledge was innovative, it is not certain whether he attributes to the knowledge principle the same centrality for society as Bell (1973) does in his discussion of the emergence of the post-industrial society. This particular theory in turn spurred the understanding of the information revolution (Postman, 1993) by installing knowledge as a primary factor of production (Drucker, 1992; Handy, 1989, 1994; Peters, 1993). Such understanding could perhaps explain why, since the 1970s, knowledge-based, rather than post-industrial, forms of organisation and economy (see e.g. Toffler, 1981; Bell, 1980) have increasingly attracted the attention of researchers.

2.2.1.2 Knowledge as an Important Production Factor

Following the recognition that a knowledge-based society has emerged, a number of descriptors have been used to highlight importance of production factor. For example, organisational knowledge has been variously described as 'the engine that transforms global economies' (Bell, 1973, 1980), 'the stuff of organisational success' (Nonaka, 1991), 'the fabric stitched together by new forms of work and new types of workers' (Blackler, 1993), and 'the stuff of governmental controls that herald the demise of private enterprise capitalism' (Heilbruner, 1976). All these metaphors seek to stress the importance of knowledge to society and to signal the changes taking place as a result of the increasing interest in knowledge. In particular, some researchers have suggested that knowledge has now become a key production factor (Drucker, 1993; Grant, 1996) in today's society. Such appreciation of knowledge as an economic factor is not new, however (Bell, 1973). What is new is economists' interest in organisational knowledge that did not emerge until later. Since then, organisational knowledge had began to be incorporated into the framework of analysis, rather than being considered as an outside influence whose evolution we seek to explain as the outcome of economic forces (Howitt, 1998).

The importance of knowledge can be explained from the standpoint of the difference between the production of capital goods and the production of knowledge. From an economist's perspective, this difference is based on the form of output. Previously, most types of physical capital took the form of physical

implementations whose value could be appropriated by a single control agent. Knowledge, unlike most types of physical capital, is embodied in people and organisations such as organisational routines (Nelson and Winter, 1982). Additionally, the difference is also evident in terms of uncertainty in the production of knowledge. As Nonaka (1991: 96) suggests, "in an economy where the only certainty is uncertainty, the only source of lasting competitive advantage is knowledge". This observation implies that, unlike the production of capital goods, uncertainty can be seen as one of the salient characteristics of knowledge. In other words, it can be said that since many physical capital investments involve replicating existing capital structures in familiar situations, uncertainty affects them less than it does the creation of new knowledge (Howitt, 1998). This particular comment demonstrates the complexities involved in the debates about the importance of knowledge and the difficulties of KM.

2.2.2 A Micro-View of KM

The emergence of a knowledge-based economy implies that the traditional, over-simplified version of managing people performing simple work using uncomplicated technology is becoming redundant. As a result, increasing attention has been devoted to the organisational (micro-level) implications of these trends.

As suggested by Scarbrough and Swan (1999), whatever the strength of the views of the macro-level context, the case for KM as an organisational practice depends much more upon micro-level processes of assimilation, learning and innovation. In

particular, six important perspectives on KM may be identified: the strategic management, taxonomic, cognitive, technological, social and managerial perspectives.

2.2.2.1 A Strategic Management Perspective on KM

This section reviews the existing KM literature that has adopted a strategic management perspective. The increasingly dynamic nature of competition has made the improvement and development of more effective methods for managing knowledge a central concern for contemporary strategic management. In general, this stream of studies argues that knowledge is fundamental to organisational competence, that is, an ability to sustain the co-ordinated deployment of assets and capabilities in a way that promises to help a firm achieve its goals.

Most KM efforts in this area concentrate on explaining what knowledge can do for organisations in enhancing competitive resources and competence (Nonaka, 1991; Prahalad and Hamel, 1990), and consider the firm as a repository of knowledge (Nonaka and Takeuchi, 1995; Fransman, 1994). They also seek to explain the relationship between knowledge and the firm, the rationale for the existence of the firm, and the analysis of knowledge integration within firms (e.g. Grant, 1996; Nonaka, 1994; Spender, 1996; Spender and Grant, 1996). Such a conception of the firm builds primarily on evolutionary models (Nelson and Winter, 1982), resource-based theory (Penrose, 1959), dynamic capability theory (Teece *et al.*, 1994), and competence-based theory (Sanchez, Heene and Thomas, 1996).

2.2.2.1.1 A Knowledge-based View of the Firm (KBV)

Drawing upon the resource-based view of the firm (RBV), Spender and Grant (1996) postulate knowledge as the most strategically important of a firm's resources. The issues with which the KBV concerns itself extend beyond the concerns of strategic management (e.g. strategic choice and competitive advantage). KBV addresses the nature of co-ordination within the firm, organisational structure, the role of management and the allocation of decision-making rights, the determinants of firm boundaries and the role of innovation (Grant, 1996).

This stream of research has made two distinctive contributions to the studies of KM. First, a firm is considered as a social entity (Grant, 1996). From a competence perspective, the firm is viewed as an entity which engages in building long-term knowledge, instead of being just market driven and flexible (Lindkvist, 1996). While the concept of core competence (Prahalad and Hamel, 1990) is seen as an alternative strategic paradigm to conventional product-market thinking, it can be considered as knowledge-dependent and closer to the construct of 'know-how' (Earl, 1997). Thus, it can be said that the focus of KM has moved from knowledge to the social entity in which knowledge is situated and constructed. It is through this particular perspective that the present research aims to examine some of the key managerial and organisational issues of knowledge sharing.

Secondly, with the emergence of the knowledge era and the ever-improving capacity of advanced information technologies, the internal knowledge ability to absorb externally-generated knowledge (Cohen and Levinthal, 1990) becomes a key issue in management research. This particular capability that a firm possesses can be seen as part of the core competence of a firm. According to Cohen and Levinthal (1990), some organisations possess an 'absorptive capacity' that enables them to recognise the value of new, external information, assimilate it, and apply it to commercial ends. While 'absorptive capacity' is in itself not the main focus of this study, the research nevertheless aims to examine and analyse the critical factors that make up that capability.

Although KBV has considerable merit, its understanding of KM tends to be monolithic and over-simplied. For example, the key problem of this stream of research is that most work has concentrated on the 'promise' side of knowledge value, while little is known about the actual organisational processes of managing knowledge (Grant, 1996). In other words, there is no precise account of knowledge in the knowledge-based approach. What has been explored in the literature is the vital importance knowledge plays in understanding organisations. As such, as noted by several researchers (e.g. Foss, 1996; Grant 1996), the knowledge-based firm theory, building on resource-based arguments, can be considered a theory that explains the competitive advantages of firms rather than their internal structure of organisational knowledge.

Secondly, this study argues that while KBV challenges many notions in current discussions of knowledge, especially the strategic value of tacit knowledge, it lacks the analytical power to understand the more social, political and economic issues related to KM. As Spender (1996: 43) comments, although Nelson and Winter (1982) and Nonaka and Takeuchi (1995) "have successfully sketched theories of the dynamic interactions of types of organisational knowledge, neither indicates how they are to be contained". This implies that there is a need for further empirical studies of the organisational processes through which knowledge is created, integrated and disseminated.

Finally, the notion of knowledge as a competitive asset, as a resource, as cognition and as something to be leveraged and valued pervades the strategic management-based KM literature. As such it focuses mainly on identifying and codifying the firm's knowledge assets so that they can be exploited and fully protected as a source of competitive advantage. However, most of the studies describe only the relationship between organisational competence and a firm's performance (Barney, 1991; Hamel and Prahalad, 1990; Leonard-Barton, 1992; Prahalad and Hamel, 1990; Amit and Schoemaker, 1993) and insufficiently operationalise the nature of knowledge and its process. For example, there is a common failure to explain how knowledge is developed and renewed in organisations (Leonard-Barton, 1995; Nonaka and Takeuchi, 1995).

2.2.2.2 A Taxonomist Perspective on Knowledge Management

The second element of this study is the recognition of different types of available knowledge. For example, it is important to distinguish between explicit and tacit knowledge (Nonaka and Tackeuchi, 1995). However, one question that is often asked and needs clarification is: 'is knowledge any different from information or data?'

2.2.2.2.1 The Nature of Knowledge

Since the early 1980s, many researchers have devoted considerable time and energy trying to define information and distinguish it from data. Generally speaking, data have been seen as entities represented in symbolic forms and capable of being processed. Information, on the other hand, is considered an output that is manipulated, re-presented and interpreted to reduce uncertainty, provide insights and improve decision-making.

In the 1990s, however, researchers have increasingly realised that potential of knowledge is a much more complex phenomenon than information (Earl, 1997). According to Cavaleri and Fearon (1997: 12), "to study the various artefacts of organisational intelligence is to view them as existing on a spectrum of refinement from data, to information, then to organisational knowledge, and finally to organisational wisdom". They argue that data are raw facts that are meaningless without a context of interpretation. Information, on the other hand, represents facts

that have a context and are ready for further interpretation. Information cannot create a shared understanding among people with different values and is dependent on the process of knowing. Once information is used by a person or group, it becomes the basis for creating knowledge through the process of 'knowing' (Cavaleri and Fearon, 1997). Fransman (1994) considers information as a 'closed set' (i.e. within confining boundaries). Knowledge, on the other hand, may easily be regarded as an 'open set', where an infinite amount of new knowledge can be created.

Instead of engaging in more discussions about the difference between information aand knowledge, this study considers the distinction suggested by Kogut and Zander (1992) as most releveant to this study. They build on Nelson and Winter's (1982) argument of the 'dualism' of the transferability of knowledge and a knowledge-based theory of the firm. They distinguish between knowledge as information (or 'know-what') and 'know-how'. "By information, they mean knowledge which can be transmitted without any loss of integrity once the syntactical rules for deciphering it was known. Information includes facts, axiomatic propositions, and symbols" (Kogut and Zander, 1992: 386).

2.2.2.2.2 The Dimensions and Types of Knowledge

The second task in understanding knowledge is to analyse it taxonomically. This was a popular approach in the early 1990s. There have been many suggestions as to how the knowledge of a firm might be categorised. A group of KM researchers,

including Nonaka and Takeuchi (1995) and Spender (1996), have developed ways to specify and classify organisational knowledge, analyse the inter-relation of knowledge types (Baumard, 1996), and assess their implications.

To start with, the first common dimension used by previous researchers is to distinguish between individual and collective knowledge (Spender, 1996). For example, according to Kogut and Zander (1992), individual knowledge is the sum total of an individual's competencies, information and knowledge. Collective knowledge, on the other hand, includes organising principles, routines and practices, top management schema and relative organisational consensus on past experiences, goals, missions, competitors and relationships that are widely disseminated throughout the organisation and held in common by a large number of organisational members (Lyles and Schwenk, 1992; Zander and Kogut, 1995; Matusik and Hill, 1998).

In Nonaka and Takeuchi's (1995) work, human knowledge is divided into two types: explicit and tacit knowledge (see also Senker, 1995; Grant, 1996; Brown and Duguid, 1991). According to them, explicit knowledge is systematic, codified and easily communicated in formal, systematic methods such as rules and procedures (Nonaka and Takeuchi, 1995; Polanyi, 1962; 1966). That is, it can be articulated in formal language, including grammatical statements. This kind of knowledge can thus be transmitted formally and easily amongst individuals. Individual explicit knowledge consists of knowledge and skills that can be easily taught or written down, whereas collective explicit knowledge resides in standard operating systems

and rules (Brown and Duguid, 1991; Lyles, 1988; Starbuck, 1992). However, there are drawbacks in the ease of its transmission to other organisations and the potential for simple imitation.

On the other hand, tacit knowledge has recently received increased attention in the organisational literature. For example, as Kogut and Zander (1992) indicate, the concept of tacit knowledge provides another perspective on understanding the capabilities and boundaries of firms. However, tacit knowledge is not available as a text and may conveniently be regarded as residing in the heads of those working on a particular transformation process or as embodied in a particular organisational context (Nonaka and Takeuchi, 1995, Gibbons *et al.*, 1994). It involves the intangible factors embedded in personal beliefs, experiences and values. For the purpose of this research, tacit knowledge is perceived as knowledge that is difficult to codify and transfer between individuals, and that exists in individuals and in the interactions between individuals and within communities of practice (CoPs).

This definition differs from Polanyi's (1966) perspective, which limits tacit knowledge to knowledge that cannot be articulated. When Polanyi first conceptualised tacit knowledge, he saw it as existing exclusively in individuals. However, recent research has made it clear that a team of interacting individuals can have knowledge that transcends the knowledge that each of them has individually (Nonaka, 1991; Nonaka and Tackeuchi, 1995). Nonaka and Tackeuchi (1995) discuss the expansion of knowledge from the individual to inter-organisational levels in great detail in his book *The Knowledge Creating Company*

(1995). In the present study, the approach to tacit knowledge is similar to that taken by Nonaka and Takeuchi (1995).

While Nonaka's (1991, 1994) work represents a useful starting point for theorising the links between tacit and explicit knowledge, other researchers have further developed typologies of knowledge based on the nature and usage of knowledge in organisations. For example, Spender (1996) suggests a 'pluralistic epistemology', seeking to capture the different types of knowledge, both individual and collective, that organisations make use of. He suggests a need for definable relationships between the different types of knowledge. In particular, he argues that there are four types of organisational knowledge: conscious, objectified, automatic and collective. According to Spender, these four types of knowledge can be sources of competitive advantage and can lead to a different knowledge-based theory of the firm.

Other attempts at categorising knowledge have also been made. For example, Blackler (1995) suggests that tacit knowledge may be found in people as embodied knowledge, in organisational routines as embedded knowledge, or in organisational culture as encultured knowledge. In other words, tacit knowledge can be found in individuals and collective groups. Specifically, according to him, individual tacit knowledge can be found in individual schemas, skills, habits and abstract knowledge (Lyles and Schwenk, 1992; Starbuck, 1992), whereas organisational tacit knowledge usually resides in top management schemas, organisational consensus on past experiences, firms' routines, firms' cultures and professional

cultures (Lyles and Schwenk, 1992; Nelson and Winter, 1982; Nonaka and Takeuchi, 1995).

According to Sanchez and Heene (1997), tacit knowledge is difficult to exploit organisationally even when it is clearly articulated. This is because to appropriate knowledge from someone else means having a shared code or mental model that enables the other to understand and accept that knowledge (Schwenk, 1988). That is, the communication of knowledge is only possible between people who, to some extent, share a system of meaning (Trompenaars, 1995). This implies that it is relatively easy to share knowledge across a group that is homogeneous, but that it is extremely difficult where the group is heterogeneous. Thus, tacit knowledge can be conceptualised as an idiosyncratic, subjective, highly individualised store of knowledge and practical know-how gathered through years of experience and direct interaction within a domain (Bennett, 1998; Nonaka, 1994; Polanyi, 1958, 1962; Spender, 1998).

The third dimension of knowledge has to do with the question of codification. In particular, according to Gibbons *et al.*, (1994), technological knowledge is also a form of knowledge that is obscured by the tangibility of its artefacts. It is a mixture of codified and tacit components. Codified knowledge need not be exclusively theoretical but it needs to be systematic enough to be written down and stored, whether in a computer, a report or some other form. As such, it is available to anyone who knows where to look. The distinction between codified and tacit knowledge can be complemented by a parallel distinction between 'migratory' and

'embedded' knowledge. The former can move rapidly across organisational boundaries, whilst the latter is less able to do so because its movement is constrained in a given network or set of social relations. Proprietary knowledge, protected by patents and trade secrecy, is codified and can be subject to licensing and commercialisation, while tacit knowledge is implicit in the professional and institutional culture of a firm (Gibbons *et al.*, 1994).

While typologies have undoubtedly advanced our comprehension of organisational knowledge by demonstrating its multi-faceted nature, they are also inscribed by certain limitations which stem from the 'formalistic' type of thinking that is inherent in any typology (Pepper, 1942: 141–4; Tsoukas, 1994: 763–4). Thus, such approach to KM studies can be problematic and must be treated with caution (Faulkner *et al.*, 1995). The specific reasons for reaching this conclusion are as follows:

This type of thinking, as Tsoukas (1996) suggests, is based on the assumptions of the observer's ability to recognise the distinctive features of the studied phenomenon.

- It analyses knowledge from a positivistic view, which suggests that we are able to access knowledge and measure it. In other words, the authors assume that knowledge phenomena can be discrete and separable, which they seldom are. "The typology approach offers a compartmentalised and static approach upon what are often dynamic processes" (Scarbrough, 1996: 32).

- The typology approach assumes that knowledge is a specific entity that resides in people's heads (Blackler, 1995).

- It assumes that knowledge can be easily categorised and converted. As Tsoukas (1996) argues, tacit and explicit knowledge cannot be easily separated as they are mutually constituted.

It is argued that the existing literature has often concentrated on explicit knowledge, and only a few studies have focused on the tacit components of organisational knowledge. Such exceptions are shown in Lam's (1997) study, as she shows how cross-border collaborative work is impeded by different types of tacit knowledge. Leonard and Sensiper, in their 1998 study on innovation, suggest that tacit knowledge play a key role in innovation.

In sum, this study argues that accepting the need to understand organisational knowledge from a broad and pluralistic perspective implies that knowledge should be interpreted as inhibiting many aspects of organisational knowledge (Spender, 1998; Blackler, 1995). In other words, as Blackler (1995) notes, what the variety of images of knowledge identified here serves to emphasise is the complexity of issues that any discussion of knowledge within organisations must address.

While the taxonomist's approach represents an important attempt to make sense of the nature and types of knowledge, its perspective is of limited use because it has focused mainly on the contents of knowledge. Although such an emphasis holds an important place in many studies of organisational and managerial knowledge

(Boyatzis, 1982; Hemphill, 1959; Silver, 1991; von Krogh and Roos, 1995), the context issues of KM have now taken on a more critical role. In other words, attempts to understand the processes and mechanisms of KM, which go beyond the contents and types of knowledge, make it necessary to explore more fundamental questions of 'why' and 'how'. In general, the 'context' issues relating to knowledge activities are under-studied. Therefore, this research aims to identify the processes and mechanisms through which tacit knowledge is shared via ICT within a context of CoPs in the case study firm.

2.2.2.3 A Cognitive Perspective on Knowledge Management

Knowledge as cognition is the classical view of knowledge. This perspective sees knowledge as a resource to be levered, processed, distributed and stored. The literature on knowledge from a cognitive perspective is critical to our recognition of the distributed and context-specific structuring of knowledge within organisations. Since the present research starts with the view that the knowledge-intensive organisation possesses a knowledge structure which is different from that of other types of organisations, it follows that there is a need to recognise the distinctively distributed and context-specific structuring of knowledge within organisations (Argyris and Schön, 1978). From this perspective, termed 'cognitivist' by Varela (1992), a number of researchers have focused on various aspects of knowledge structures, processes and their impacts on organisational behaviour (e.g. Tsoukas, 1996; Spender, 1996; Walsh and Ungson, 1991). They seek to understand organisations as distributed knowledge systems. Such a perspective has previously

been adopted in understanding the cognitive aspects of KM and organisational learning (Walsh and Ungson, 1991; Stein, 1995; Fahey and Narayanan, 1986; Prahalad and Bettis, 1986; Walsh, 1995; Fiol and Huff, 1992).

2.2.2.3.1 Knowledge Structures

One particular group of cognitive researchers has made attempts to study knowledge structures. For example, taking a more sociological perspective, Sandelands and Stablein (1987) discuss the "concepts of the organisation mind" and Douglas (1986) describes how societies and the structure of institutions affect the cognition of the individuals within them. Argyris and Schön (1978) suggest that an organisation is a 'cognitive enterprise' and that its structure (knowledge structure) is different from organisational culture and climate. According to Lyles and Schwenk (1992), the knowledge structure is different from organisational culture and climate in two ways. First, it is narrower than culture and climate; it deals with goals, cause-and-beliefs; and it possesses distinctive cognitive elements. Secondly, a knowledge structure is more clearly linked to an organisation's strategy for survival than culture.

The present study takes the view that an emergent collective knowledge structure is formulated when a group of people get together, each bringing with them their own knowledge structure about a particular information environment (Reger and Huff, 1993; Langfield-Smith, 1992). Such collective knowledge structures can be considered as mental templates that, when imposed on an information environment

gives it form and meaning, and in so doing, serve as a cognitive foundation for action (Fiske and Taylor, 1991; Lyles and Schwenk, 1992). Moreover, this research also recognises that while organisational knowledge structures are socially constructed and rely on consensus or agreement (Daft and Weick, 1984; Hedberg, 1981; Weick, 1979), the processes of developing the organisational knowledge structure within a 'cognitive enterprise' (Argyris and Schön, 1978) is on-going and continuous (Lyles and Schwenk, 1992).

2.2.2.3.2 Organisational Knowledge Memory

Part of the knowledge structure is the so-called 'knowledge memory'. The role and importance of organisational memory is critical to this study's attempt to understand organisational knowledge-related issues (Walsh and Ungson 1991; Stein, 1995). According to Walsh and Ungson (1991), a major building-block in implementing KM is the organisational knowledge memory, and this has been an increasingly active area of concern in KM research (Walsh and Ungson, 1991; Stein, 1995). In particular, studies of new kinds of organisational memory, their characteristics and potential have been widely discussed (Huber, 1991; Stein and Zwass, 1995). Organisational memory comprises standard operating procedures (March and Simon, 1958) or routines (Nelson and Winter, 1982). Others have focused on organisational culture (Barney, 1986) as the repository of knowledge. For example, Walsh and Ungson (1991) define organisational memory as stored information from an organisation's history that can be brought to bear on present decisions. For Stein (1995: 22), it is "the means by which knowledge from the past

is brought to bear on present activities, thus resulting in higher or lower levels of organisational effectiveness" (Stein, 1995: 22).

Despite the fact that organisational structures and organisational memory remain two of the core concepts in information-processing theories (Johnson and Hasher, 1987; Richardson-Klavehn and Bjork, 1988; Shannon and Weaver, 1949), our knowledge of organisational structures and memory remains limited. According to Tsoukas (1996), the main contribution of this body of literature (e.g. Sandelands and Stablein, 1987; Weick and Roberts, 1993) is to provide us with an understanding of how collective knowledge is distributed among individuals. As such, most of the work in this area attempts to understand KM from an information processing view of the firm, but this possesses limited explanatory power in today's dynamic business environment (Nonaka and Takeuchi, 1995). The cognitive model emphasises the codification of knowledge and is primarily concerned with its retention and circulation within the organisation. Such an information-processing model of cognition (Boland and Tenkasi, 1995) portrays communication as a message-sending and message-receiving process that utilises language as its transmitter. This over-simplified view has been questioned by others, in particular Varela (1992: 336), who points out that "cognition consists not of representations but of embodied action. Correlatively, the world we know is not pre-given; it is, rather, enacted through our history of structural coupling".

One obvious shortcoming of previous work in this area is the tendency to deal only with behaviour without attempting to understand how knowledge is retained and

used (Lyles and Schwenk, 1992). Furthermore, knowledge has usually been considered solely as a cognitive analytical entity that is possessed by individuals. Such an assumption is also made by IS and IT researchers in their attempts to explore and explain how organisational knowledge can best be managed (Finerty, 1997). This view is reflected in the available computer-based tools and methodologies that are applied in KM. To sum up, the cognitive model is arguably the most pervasive approach to KM, and is driven in large part by the increasing availability of information-based tools such as groupware and Intranets.

2.2.2.4 A Technological Perspective on Knowledge Management

In an information-age economy, it is recognised that KM is increasingly dependent on ICT to transfer information and knowledge (Huber, 1984; Drucker, 1994; Schein, 1993). Much of the existing KM in this stream is driven by an information processing perspective and is based on the belief that ICT-based KM systems can be used to capture, disseminate and make knowledge accessible to everyone in the organisation. The main concern is with how information technologies provide support for the co-ordination of knowledge through access to technological capabilities such as common repositories, discussion forums, and communication facilities (Orlikowski, 1996). Such technologies "have the potential to provide people with the capacity to communicate across boundaries of time and distance and to increase the ease and effectiveness of their work" (Galegher *et al.*, 1990: 3).

According to Sarvary (1999), two important IT development areas have contributed to the birth of modern KM systems: communication and relational databases. Since the late 1970s and early 1980s, developments in artificial intelligence, expert systems, intelligent knowledge-based systems, and complementary challenges around knowledge engineering, symbolic representation and manipulation, have stimulated researchers to re-assess knowledge. This stream of research, focused on computer technology, has provided us with such concepts as knowledge acquisition, knowledge engineering, and knowledge-based systems. Technical difficulties relating to technologies and techniques in creating and transferring knowledge have been made transparent in the field of organisational knowledge research and have contributed to the advancement of information technologies.

2.2.2.4.1 The Use of ICT for Knowledge Sharing

The rapid advancement and the growing popularity of 'groupware' have contributed to the recent growth of interest in the use of ICT as powerful means of codifying and collectivising organisational knowledge in the organisations. Proponents of technology-driven KM argue that by delivering sufficient knowledge into an ICT-based knowledge system, through learning, knowledge grows exponentially. This 'school of thought', which has its roots in computing, artificial intelligence and systems-management, sees excellent knowledge-based systems as the crucial answer to knowledge sharing (Finerty, 1997).

However, what differentiates the present KM study from most previous work in this field is its emphasis on the interactions between the use of ICT and the users for knowledge sharing. This research argues that the current conceptualisation of ICT-based KM is insufficient because it imposes the traditional information-processing model on the strategic needs of contemporary organisations. That is, despite the growing popularity of the information-based literature, it lacks a strong basis to integrate differentiated knowledge and expertise and facilitate mutual learning (Tenkasi and Boland, 1996). One possible reason could be that the ICT-based KMS implemented are often seen to have clashed with the corporate culture within organisations (Leidner, 1999). Such a shortcoming is evident in some of the previous developments of ICT for KM which have has failed to consider the multi-faceted, context-dependent characteristics of tacit knowledge. One possible reason for this problem is that, as with much of the literature in this area, KM is often reduced to the implementation of new ICT systems for knowledge sharing and data 'mining' (Leonard-Barton, 1995). Such a perspective appears to have been built upon the cognitive models that suggest that information technologies have provided new tools better to perform knowledge activities (Scarbrough *et al.*, 1999).

Therefore, the desire to understand the organisational and social aspects of the use of IT-based KMS requires us to address important recent contributions to our understanding of technology. The anchor point of this research is the interest in understanding the inter-relationship between social and technical elements in the use of IT. As previous studies of technology (Hickson *et al.*, 1969, Blau *et al.*, 1976; Barley, 1986, 1990) show, humans are largely determined by, rather than

have influence over technology. This perspective is loosely termed 'technological determinism' and focuses solely on the capacity and capability of technology. In other words, "technology is assumed to have objective effects which can be measured and predicted and which are largely unaffected by the human actors involved" (Grint and Woolgar, 1997: 7). Technology is thus usually treated as a variable that stands outside social analysis (Grint and Woolgar, 1997). The critical discussions of technological determinism have led many researchers to accept the significance of factors other than 'technology', such as social and economic forces.

Three main views are discernible in the debate on technology–society–human interaction.

- The duality of technology view (Orlikowski, 1992) suggests that social factors influence the effects that technologies are capable of by designing, producing and at the same time influencing their social context.
- The social constructivist view (Bijker *et al.*, 1987) suggests that the configuration, uses and effects of technologies are largely shaped by their social contexts.
- The socio-technical view (Trist *et al*, 1951; Mumford, 1999) provides powerful arguments for a more holistic view which recognises the interplay between social and technical factors.

Thus, the following sections examine the relationship between organisations and technology from the 'duality of technology', social construction perspective and socio-technical systems standpoint.

2.2.2.4.2 The Duality of Technology

Researchers are increasingly becoming particularly interested in understanding more about the interplay between the use of technology and its organisational implications. In Orlikowski's (1992) groundbreaking work, a structural model of technology was developed. She began by criticising Barley's (1986, 1990) perspective for its lack of attention to the change in technology during the period of its deployment. She then identified how the previous definitions of technology have themselves generated problems. For example, she pointed out that previous technological studies have considered technology as hardware (Zuboff, 1988). Such hardware-driven studies have been criticised as deficient by ignoring the action of people in developing, appropriating and changing technology (Orlikowski, 1992). Rather, based on the earlier work of Giddens (1979, 1984), which sees institutional structures as having a dual character, she developed the view that technology is constantly interacting with the organisation. According to her, technology has a dualistic influence on organisations. This approach also implies that technology and its social context are mutually interdependent. Technology is constructed and enacted by human agents, and at the same time, it constrains or enables human action (Orlikowski, 1992).

The main weakness of the approach, however, as Monteiro and Hanseth (1996: 328) suggest, is that "they [studies of the duality of technology] are not fine-grained enough with respect to the technology to form an appropriate basis for understanding or to really inform design". The studies (Orlikowski, 1992;

Orlikowski and Robey, 1991; Walsham, 1993) conducted so far lack the ability to provide specific details on how and where IT restricts and enables action in relation to organisational issues (Monteiro and Hanseth, 1996). Nevertheless, the duality of technology approach identifies "prior views of technology – as either objective or as socially constructed product – as a false dichotomy" (Orlikowski, 1992: 405–6). Rather, she concludes that "technology has a dual nature – as objective reality and as socially constructed product" (p. 423).

2.2.2.4.3 The Social Construction Perspective

On the other hand, broadly speaking, the social construction approach (Grint and Woolgar, 1997) is concerned with the influence of subjective human interpretation on the generation of knowledge. This perspective is considered as a strong antidote to technological determinism and is often portrayed as an effective analytical 'cure-all' (McLoughlin, 1999). It stems from the theory of the social construction of reality (Schutz, 1962; Berger and Luckmann, 1966).

At the centre of this social constructivist concept is the belief that there is no 'real' or static knowledge and that knowledge is always embedded in social interactions within communities rather than being an asset that can be processed and disseminated. The social and technical debate within this school of thought suggests that the social embeddeness of technical systems needs to be understood as an enactment of social reality (Weick, 1995). It rejects any self-evident account of the effects of the material aspects of technologies. Inhibiting or facilitating effects are a

matter of interpretative action by people in their social context. Moreover, this approach regards the social and technical elements as a 'seamless web', where no clear distinctions between the technical, social, economic and political `elements of technological development are made (Bijker *et al.*, 1987).

2.2.2.4.4 Socio-Technical System Theory (STS)

Finally, the third approach is called Socio-technical System Theory (Trist, 1982). This is also the approach which is adopted in this study to explore the interrelationships between technology and organisational factors. In adopting and developing a socio-technical perspective on knowledge sharing, we need to be mindful of both the strengths and weaknesses of this school of thought. Trist first coined the term 'socio-technical thinking' in the 1930s in a study of the Coal industry in Scotland. He realised that the technological and social systems were having a negative effect on each other. As a result, he developed a new approach for the design of work organisation: socio-technical systems design (Trist, 1982). The term 'socio-technical' (Trist and Bamforth, 1951) is used to describe a method of viewing organisations which emphasises the inter-relatedness of the functioning of the social and technological subsystems of the organisation, and the relation of the organisation as a whole to the environment in which it operates. According to Pasmore *et al.* (1982), "the socio-technical system view contends that organisations are made up of people that produce products or services using some technology" and that each "affects the operation and appropriateness of the technology as well as the actions of the people who operate it" (p 1182). Similarly, Mumford

(1999:29) suggests that it is an approach that tries to "combine the effective use of technology with the effective and humanistic use of people".

A key feature of the concept is its primary objection towards a mechanistic system paradigm (i.e. Taylorism) that views productive efficiency as the primary focus. It also sees the integration of social and technical elements as an important part of a manager's job. The ideas of the 'joint optimisation' of technical and social factors and 'open systems planning' have provided a fresh viewpoint for creating new organisation designs, distinct from that of industrial engineers or behavioural scientists (Trist, 1982). In particular, socio-technical principles and practices have been developed and applied to routine, linear work systems (Fox, 1995). In other words, conventional STS design has been geared primarily towards linear work systems dominated by programmed tasks (Pava, 1986).

In recent years, the STS approach has come under fire for becoming overly prescriptive and for failing to address important empirical trends. According to Pava (1986), some of the problems stem from an over-reliance on one successful method and a single template (the autonomous work group) for organisation design. Equally, broader changes such as the advent of IT and new possibilities of networked organisations and virtual patterns of interaction have posed problems for the conventional socio-technical focus on the point of production (Scarbrough, 1995). These critiques of STS suggest the need for a renewal of the perspective if it is not to become obsolete. Pava (1986), for example, is confident that "if it can be

re-mobilised, the STS approach could play a vital role in an era of far-reaching change" (p. 19).

Mumford (1999) has identified three fundamental challenges facing researchers working in the area of socio-technical systems design or using socio-technical thinking as an analytical lens for understanding new organisational phenomena: 1) The need to learn how to apply socio-technical principles to the remote network of employees communicating electronically in the automated office of the future. 2) The need to know whether it is possible to form autonomous groups which are physically distant from each other and communicate via terminals. 3) The need to learn how socio-technical principles can be applied to large multinational establishments at the macro-social level.

The adoption of a socio-technical approach to the organisation of knowledge sharing may help to meet the challenges identified by Mumford (1999). This could shed some light on the efforts to update socio-technical thinking for today's globalised business context. Therefore, in acknowledging the problems of traditional socio-technical thinking, this research aims to adapt some of the important features of socio-technical system theory and introduces two new elements to the analysis.

First, the research recognises that in today's context, the socio-technical relationship of an organisation is not as simple as organising a set of social relations and stable production technologies, as in the 1950s and 1960s. Rather, it argues that

current socio-technical thinking should possess the ability to integrate much more complicated social relations and technological advancements. For example, the traditional concept of a physically autonomous workgroup is disappearing; instead, the notion of managing or nurturing 'virtual CoPs' is fast becoming the core of many of today's managerial activities. This particular trend towards the nurturing of virtual CoPs forms the core of the present research.

Secondly, the issue of embeddedness is also critical and relevant to the research. This starts with the belief that, in today's globalised business environment, a socio-technical view of knowledge sharing is inseparable from the embedded artefact of the ICT-based system. This is evident as more and more organisations are staffed with workers who possess expertise and knowledge and who are responsible for operating the technological systems involved in knowledge work. Therefore, their subjective interpretation of the technological systems could have important bearings on the outcome of the particular knowledge work.

It can thus be seen that the adoption of a socio-technical perspective towards an ICT-based KMS provides us with a useful framework to address some of the key issues relating to knowledge sharing. In particular, it enables us to appreciate how social behaviour might influence the use of ICT and vice-versa. It also provides an alternative understanding of technology, especially in today's knowledge-driven business context. Unlike other approaches, it aims to analyse the embeddedness of social and technical systems in terms of the human perception of the environment. It seeks to open the 'black box' of technology by showing how artefacts can be

viewed as both culturally constructed and interpreted, not just in terms of how they are viewed by different groups, but more fundamentally in terms of the actual design of technology and technological systems (McLoughlin, 1997).

In sum, this study argues that much of the KM literature in this area has focused only on access and the retrieval of information and knowledge enabled by ICT: "The rational information processing model and its manifestations in information system design have looked at knowledge integration with an unproblematic treatment of the notion of a message, a continuing tradition in knowledge intensive firms" (Tenkasi and Boland, 1996: 83). What is conspicuous by its absence is a discussion of collaboration as a regenerative source of ideas and intellectual capital (Neilson, 1997). Taking a similar view, Nonaka and Takeuchi (1995) emphasise that only people can take the central role in knowledge creation. ICT are merely tools, however great their information-processing capabilities may be. Finally, although the importance of ICT to KM is well recognised, it is probably reasonable to predict that the most dramatic improvements in KM capability will be human and managerial (Davenport, 1995).

2.2.2.5 A Social Perspective on Knowledge Management

In recent years, by moving away from a technology focus, KM researchers have begun to appreciate and emphasise the importance of human factors (including the ownership of knowledge and organisational factors that facilitate the creation and dissemination of knowledge). KM articles pertaining to social issues started to

appear in the early 1990s in journals such as *Strategic Management Journal* (Grant, 1996), *Sloan Management Review* (Senge, 1990; Stata, 1989; Leonard-Barton, 1992), *Organisational Dynamics* (Agyris, 1989) and *Harvard Business Review* (Nonaka, 1991). At the same time, influential books on organisational learning and KM (e.g. Senge, 1990; Nonaka, 1994) were also widely read. The shift in focus from resources to knowledge of the resources is central to Spender's (1996) argument for a pluralistic view of knowledge. He argues that a pluralistic epistemology is necessary. "In brief, our thesis is that a knowledge-based theory of competitive advantage cannot work unless it embraces several different types of knowledge" (Spender 1996: 39). This argument seems to imply that a broad and pluralist approach to organisational knowledge is needed. This view is well supported by Blackler's (1995: 1026) point: "What the variety of images of knowledge identified here serves to emphasise is the complexity of issues that any discussion of knowledge within organisations must address".

The social perspective points to the need to better understand and examine the issues relating to the locus of knowledge. In other words, the issue of knowledge context is of supreme importance. But, before addressing the issue of knowledge context in more detail, some comments are in order on the current shift in research focus from a concern with knowledge itself to an interest in the process of knowing.

2.2.2.5.1 From Knowledge to the Process of Knowing

Cohen (1998) suggests that the noun 'knowledge' implies that knowledge is a 'thing' that can be located and manipulated as an independent object or stock. It seems possible to 'capture' knowledge, to 'disseminate', 'measure' and 'manage it'. On the other hand, the gerund 'knowing' suggests a process, the action of knowers, and is inseparable from them. To the proponents of the 'knowing' concept, it is impossible to capture, distribute or measure it meaningfully. Rather, it is more feasible to 'promote', 'nurture', and 'encourage' knowing. In short, knowing is an active, lived experience in a constant state of tension with knowledge as a commodity within firms and markets (Blackler, 1995).

This research proposes a holistic view of knowledge sharing, it is not only primarily interested in knowledge as a static resource but also on how its knowledge is socially constructed. Similarly, as Blackler (1995) points out, most of the extant theoretical viewpoints are based upon seeing knowledge as a distinct entity, something that people possess. Therefore, by considering the dynamics of social interactions in organisation, it becomes apparent that a more appropriate focus is on the act of knowing, rather than the abstract concept of knowledge. Thus, in this research, the processes of 'knowing' are considered more important than the stock of knowledge. This view is also supported by previous studies such as Nonaka and Takeuchi (1995: 235, italics in original) who noted, "We have repeatedly emphasised that the focus of this book is on knowledge *creation*, not on knowledge

per se. From our perspective, knowledge creation fuels innovation, but knowledge per se does not".

Generally speaking, while some scholars hold a technological-deterministic view in suggesting that information and communication interaction are key enablers for knowledge activities, others have argued that tacit knowledge cannot be exchanged via electronic means, a view which has clear implications for the capacity of 'communities of practice' (Brown and Duguid, 1991). For example, Spender (1996) concludes that we have to consider a firm's knowledge as part of the complex relationships of quasi-objects of activity systems where background and foreground knowledge is interwoven. According to Nonaka and Tackeuchi's (1995) model of knowledge creation, the individual is the knowing subject; an organisation cannot generate knowledge on its own without its employees. They argue that organisational context provides the shared space or 'ba' (Nonaka, 1998) to allow interaction between individuals so that ideas develop and become materialised. Organisations are thus very important in providing the knowledge generation context for employees. These comments point towards the importance of understanding and exploring the locus of knowledge or process of knowing in our study.

2.2.2.5.2 The Importance of Context

Due to the nature of knowledge, knowledge work and knowledge workers, one of the most critical challenges facing knowledge-based organisations is to ensure that

the appropriate context is established. The importance of context has been widely appreciated in the study of knowledge work. For example, Teece (1998) defines knowledge as "information in context"; Brown and Duguid (1998) argue that shared practice creates shared context; Glazer (1998) suggests that the value of knowledge depends on its context. According to Cohen (1998), the context provided by the conversation suggests that members understand context in roughly the same way. More importantly, Junnakar and Brown (1997) highlight that knowledge managers interested in the role of IT as an enabler should not only emphasise the connectivity between people and information but how to develop an organisational enviornment conducive to tacit knowledge sharing.

Taking a similar view, Brown and Duguid (1991) suggest in their analysis of CoPs that shared learning is inextricably located in complex, collaborative social practices. Moreover, Nonaka (1994) observes that when people gather together in 'communities of interaction', a dialogue exists between tacit and explicit knowledge. It is the dialogue that drives the creation of innovation. The theory of Nonaka and Tackeuchi (1991) on knowledge creation explains how the dialogue between tacit and explicit knowledge can enlarge and enrich understanding and can result in new knowledge. They further suggest that the intermingling of explicit and tacit knowledge nurture a favourable environment for knowledge transfer and learning.

While these studies highlight the importance of the social aspects of KM, they seem to neglect the technological aspects of KM, which play an important enabling role.

Therefore, as far as this study's treatment of the issue of knowledge sharing is concerned, this study argues that knowledge context is vitally important, and its definition goes beyond the social elements. This follows the suggestion of Bahrami and Evans (1997: 23) that knowledge context refers to "the physical, technological, symbolic (visual reinforcers of cultural norms), and organisational environment within which knowledge workers operate".

Thus, our definition of knowledge sharing acknowledges the significance of socially-embedded forms of knowledge as a source of value differing from the simple aggregation of the knowledge of a set of individuals (Nahapiet and Ghoshal, 1998). The research also argues that the elements of context include images, gestures, cultural norms, physical settings, historical information, strategies, trends and technology. However, so far in the literature, very little attention has been given to the conditions of knowledge communities for knowledge sharing.

2.2.2.5.3 Communities of Practice (CoP)

The realisation of the importance of context has led this research to focus on the notion of evolving CoP within organisational boundaries. This concept has been recognised in a number of earlier works focusing on sensemaking (Weick, 1979), CoP (Lave and Wenger, 1990; Orr, 1990; Brown and Duguid, 1991), storytelling (Orr, 1990), communities of knowing (Boland and Tenkasi, 1995). 'Community of practice' is a useful metaphor for describing a large supportive context of KM activities. This term is borrowed from learning theorists Lave and Wenger (1991),

who define it as "an activity system about which participants share understandings concerning what they are doing and what it means in their lives and for their community. Thus, they are united in both action and in the meaning that that action has, both for themselves and for the larger collective" (p. 98).

Previous studies have explained in detail how community members enact the meaning of community-based artefacts, drawing on structural work in organisations (Orlikowski, 1992; Brown and Duguid, 1991; Wenger, 1990; Tenkasi and Boland, 1996; Pentland, 1995). Other CoP studies have also previously addressed research deficiencies relating to learning and competence. While group researchers argue that leaders should move organisations from 'control to commitment' (Walton, 1985), CoP research implies that organisations must convert commitment to capability.

According to Kogut and Zander (1996: 503) "a firm can be understood as a social community specialising in the speed and efficiency in the creation and transfer of knowledge". Such a view is similar to Peters' (1993) observation that knowledge-intensive organisations have made explicit efforts to develop CoPs. Although most of the previous KM studies were concerned with communicative, cognitive and linguistic issues, it is becoming increasingly popular to examine CoPs as the centre of focus for KM.

One possible way to approach the concept of CoP is to look at the interaction between people and technology in organisations. This relationship has previously

been examined by a number of scholars. Constant (1987) argues that most historical treatments of technology fall into one of two broad traditions: intellectual and artefactual accounts. Proponents of the intellectual tradition have largely followed Layton's (1976) lead and perceived technology as knowledge possessed by a 'mirror image twin' to the scientific community. The artefactual tradition, on the other hand, is primarily concerned with entrepreneurial activity and market demand as the dominant factors. Constant (1987) sees communities of practitioners as the social locus of technological knowledge, organisations as the social locus of technological functions, and socio-technical macro-systems as the broader dynamic and holistic structural context of both.

Thus, in this research, a KM-focused CoP is defined as a locus consisting of knowledge workers who are informally as well as contextually bound by a shared interest in knowledge sharing, and in applying common practice. The notion of a CoP also suggests that its boundaries do not correspond with typical functional boundaries. Rather, it includes practice- and person-based networks.

Most previous research into CoPs has focused on organisational learning and new product development and innovation, with just a few writers exploring the complex, dynamic inter-relationship between social issues (such as culture, trust, reward systems and leadership) and technical issues (such as the use of IT and organisation knowledge memory).

In addition, students of organisational learning (Wenger, 1991; Brown and Duguid, 1991) have also used the concept of CoP to explain the learning behaviour of an organisation's employees as members of such communities. In particular, ethnographic research conducted at Xerox Parc (Brown and Duguid, 1991) identified the importance of using a CoP as a unit of analysis for organisational studies. To date, CoP research has provided a variety of perspectives to analyse the nature of both the conditions and the learning processes in communities. In another example, Brown and Duguid (1998) identify the 'phase gates' of processes which form the intersecting points of different communities. 'Boundary objects' are documents that communities use. Via the shared documents, people of different communities are connected and new understanding is generated as the meaning of the object is negotiated. Of the interactions within and among communities, knowledge brokers are important agents of knowledge flows.

In an attempt to further elaborate his model of knowledge creation, Nonaka (1998) draws on the work of the Japanese philosopher Kitaro Nishida and his concept of 'ba' (roughly translated as 'place' or 'shared space'). This 'ba' concept is adapted to situate the dynamics of knowledge creation. Knowledge, according to Nonaka (1998), is embedded in 'ba', where it is then acquired through one's experience or reflections on the experiences of others. Four different types of 'ba' were developed as "part of the process by which new knowledge is created, shared and embodied in action" (Nonaka, 1998: 46–7). These are: originating 'ba' (the space that encourages the flow of tacit knowledge between individuals and its creation); interacting 'ba' (the space where tacit knowledge is made explicit); cyber 'ba' (the

place where explicit knowledge is combined with existing explicit knowledge); and exercising 'ba' (the space where explicit knowledge is converted to tacit knowledge). Thus, it can be seen that the works of Nonaka (1998) and Brown and Duguid (1998) are situated in a complex, unified organic system where organisational context and processes are part of the key elements that make a creative community. They both suggest that these communities or 'ba' can be nurtured and facilitated but not managed or constructed.

Despite previous efforts in understanding the formation and nurturing of communities, there is still a lot to be learned. Thus, rather than analysing the roles of teams within traditional hierarchical boundaries, this research aims to situate the knowledge-sharing process within a community-based context. In this sense, in terms of knowledge sharing, an organisation is seen as a web of CoPs (Brown and Duguid, 1991). Therefore, the research aims to follow Nonaka and Takeuchi (1995) in adopting an interactional stance (Burrell and Morgan, 1979) towards understanding the interplay between ICT and knowledge sharing processes within CoPs.

The aim is to shift the current debates on knowledge as a resource and knowing as a socially constructed process to knowledge as an outcome of the interplay between social and technical contexts in knowledge sharing-activities. This view supports Nonaka and Takeuchi's (1995: 59) suggestion that "The organisation supports creative individuals or provides contexts for them to create knowledge. Organisational knowledge creation, therefore, should be understood as a process

that 'organisationally' amplifies the knowledge created by individuals and crystallises it as a part of the knowledge network of the organisation".

2.2.2.5.4 Knowledge Culture and Trust in the Context of Organising Knowledge Sharing

In recognising the importance of CoPs in knowledge sharing, two particular issues seem to be critical in the research: knowledge culture and trust. In the organisational culture literature, "culture is examined either as a set of assumptions or as a set if behaviours, or norms, are a fairly visible manifestation of the mental assumptions..." (Leidner, 1999:537). For example, Schein (1985) suggests that organisational culture can be considered as the set of shared, taken-for-granted implicit assumptions that a group holds and that determine how it perceives, think about, and reacts to its various environments. On the other hand, culture is also understood as being reflected on organisational rituals, stories, symbols, myths, power structures, organisational structures, and control systems (Johnson, 1992).

In the context of KM, previous studies have highlighted, according to Leidner (1999), a number of facilitating conditions which include trust, interest, and shared language (Hanssen-Buer and Snow, 1996). They are found useful in fostering access to knowledgeable members (Brown and Duguid, 1999), and in facilitating a culture marked by autonomy, redundancy, requisite variety, intention, and fluctuation (Nonaka, 1994). Moreover, McGill and Slocum (1993) categorise the organisational orientation which involves analysing and disseminating information

concerning change into four fundamental cultures: knowing, understanding, thinking and learning. From their point of view, a knowing culture is dedicated to determining the best way of undertaking the functions of organisation. An understanding culture is an organisational culture that establishes strong cultural values that become the 'ruling myth'. A thinking culture is a culture which portrays business as a series of problems where the value of management is in identifying and isolating problems and in collecting information on how to solve problems. A learning culture is a culture that encourages experimentation, promotes constructive dissent, acknowledges failure and promotes an open, continuous dialogue with stakeholders.

In terms of the relationship between organisational culture and the implementation of KMS, the research takes an organisational imperative view-that organisational factors influence the successful implementation and use of ICT-based KMS. In others words, this study argues that the interplay of organisational factors (including the nature and use ICT, organisational and other managerial factors) play a big role in the success of the KM.

Another important issue is the importance of trust for knowledge sharing. Trust has a major impact on relationships between organisational groups (Nelson and Cooprider, 1996). According to Rotler (1980), trust is defined as a generalised expectancy or belief held by an individual that another individuals' word – in an oral or written statement -- can be relied upon. Alternatively, it is defined as "a set of expectations shared by all those in an exchange" (Zucker, 1986). In terms of the

characteristics of trust, one previous study (Barker and Camarata, 1998) has identified trust to possess the capability of influencing co-ordination and control, overcoming organisational and individual inadequacies; and affecting perception of quality work life. In another account, Jarvenpaa *et al* (1998) exploe the issues of trust in global virtual teams.

A long-term commitment, relationship and mutual understanding are also important characteristics of the type of trust identified in this research. This type of trust is seen as necessary for loosely knit, highly flexible organisational structures, and is made up of both cognitive and affective dimensions (Drucker, 1994). The attainment of mutual trust leads to knowledge sharing. As suggested by Anderson and Narus (1990), repeated intergroup exchange communications build trust, leading to increased communications and the eventual sharing of knowledge. Previous organisational research (Moorman *et al.*, 1992) has identified trust as a facilitating factor in terms of the quality of interactions and involvement levels. Moreover, it is suggested that by alleviating the fear of the unexpected and facilitating interactions and involvement (Bradach and Eccles, 1989), trust encourages a culture conducive to the sharing of knowledge.

2.2.2.6 A Managerial Perspective on Knowledge Management

Building on the need to understand CoPs as a means of sharing knowledge in a dispersed organisation, the roles played by the managers need to be closely scrutinised. Our previous review of the social aspects of KM has identified the

importance of understanding the 'knowing' processes and managerial practices of KM (both formal and informal) that are social and technical. The shift in the appropriation and application of knowledge has a range of resulting organisational implications, namely, our understanding of knowledge intensive firms, knowledge work, and the emergence of knowledge workers.

2.2.2.6.1 Knowledge-intensive Firms

To begin with, a number of researchers (Boisot, 1987; Despres and Hiltrop, 1995) have attempted to define the concept of a knowledge-intensive firm (KIF). For example, Starbuck (1992) perceived KIFs as organisations that have distinctive characteristics associated with their role in promoting knowledge dissemination and learning across the organisational context (Boisot, 1987). On the other hand, Despres and Hiltrop (1995: 11) argue that the distinctive competence of KIF is "individuated and transportable, resident in the people on whom the organisation depends for transformational processes and product outputs".

To date, however, only limited attempts to research KIFs have been made (see Alvesson, 1993; Starbuck, 1992; Nonaka and Takeuchi, 1995; Sveiby, 1997). For example, Starbuck (1992, 1993) studied a law firm, a think tank and an engineering firm to reveal that knowledge work can be complex and difficult. Sveiby (1997) studied KIFs in several industries, concluding that customisation of problem solving is a core facet of KIFs. Nonaka and Takeuchi (1995) studied KIFs in an attempt to explain the role and nature of knowledge work in innovation. However,

the previous efforts to define KIFs have proven difficult, not least because the issue of knowledge itself causes controversies in management theories (Blackler *et al.*, 1993).

Blackler (1995) argues that, as previous studies of knowledge-intensive firms (Sveiby and Lloyd, 1987; Starbuck, 1992, 1993; Alvesson, 1993) and knowledge workers (Reich, 1991; Drucker, 1992) show, knowledge workers are becoming the most important means of knowledge production. Their problem identification activities give rise to a larger degree of 'embrained' knowledge in organisations. Moreover, as the management of knowledge workers is becoming more complex, it requires new managerial skills. As Starbuck (1992) and Alvesson (1993) suggest, cultural aspects play an important role in accomplishing the management of knowledge-intensive firms. All these studies lead to the realisation of a shift in knowledge focus in contemporary organisations. The nature of the shift suggests a departure from "dependence on the embodied and embedded knowledge towards embrained and encultured knowledge" (Blackler, 1995: 1029).

2.2.2.6.2 Knowledge Work

While the focus of current research on KM has moved from knowledge to the process of knowing activities taking place in virtual CoPs, the managerial issues of knowledge-based intellects (Quinn, 1992) have become a critical issue for many knowledge intensive organisations. One implication of this perspective is the understanding of knowledge work. There are different kinds of tasks that are

loosely termed 'knowledge work', and "individual knowledge workers typically engage in a wide variety of behaviours when gathering information or knowledge, solving problems, creating new knowledge, and communicating the information and/or knowledge they have created" (Ware and Degoey, 1998: 2).

Previous studies have highlighted a number of different factors important to our understanding of knowledge work. According to Boland and Tenkasi (1995), it involves the creation of new understandings of nature, organisation or markets and their application by a firm in valued technologies, products or processes. A critical feature of knowledge work is that it requires multi-disciplinary expertise and mutual learning in order to achieve a complex synthesis of highly specialised state-of-the-art technologies and knowledge domains (Leonard-Barton, 1992). Another important dimension of the understanding of knowledge work is the use of ICT as a means of supporting knowledge activities. More and more knowledge-based organisations are adopting information communication technologies as an enabling tool for augmenting the number of knowledge workers. As a recent OECD report (1996: 13) notes, "ICTs allow for increased codification of knowledge, that is its transformation into 'information' that can easily be transmitted ... through codification knowledge takes on more and more the properties of a commodity". Indeed, some job categories have been reclassified to accommodate knowledge working (Porat, 1977), and some researchers even argue that knowledge workers already form the dominant sector of Western work forces (OECD, 1981). Since the late 1980s, this view has been supported by various authors such as Zuboff (1988),

Kumar (1995) and Handy (1989), who argue that knowledge workers in knowledge-intensive firms (Starbuck, 1992) are becoming increasingly important.

2.2.2.6.3 The Emergence of Knowledge Workers

The capability of an organisation to increase the learning capacity of its knowledge workers has become a competitive advantage in itself (Nonaka and Takeuchi, 1995). In particular, for knowledge-based organisations, the rise to primacy of knowledge workers creates both opportunities and challenges, especially in the management of people (Drucker, 1993). The role of the manager in the knowledge-based era will be to organise the 'knowledge sharing' context in which work is done, rather than to control the workers themselves (Stewart, 1997; Sveiby, 1997).

This study argues that the debate is now moving away from the personal attributes of knowledge workers to focus on the work that they perform and the tools and systems that may facilitate learning within that work (Quintas *et al.*, 1997). It is widely recognised that knowledge workers pose a challenge to conventional management practice. For example, knowledge workers would more likely to expect to be compensated based on their input of expertise and creativity, rather than for their labour in terms of hours spent. Such expectation could results in some potential conflicts between the knowledge workers and the management team. In particular, the emergence of knowledge workers has been seen as a product of four related developments: the relative decline of the professional model; the increasing importance of knowledge work in the experience of a range of occupational groups;

the codification and commodification of knowledge through new ICT; and the emergence of new sectors of knowledge production within the economy (Scarbrough, 1999a).

According to Drucker (1993), 'knowledge workers' are individuals who have high levels of education and specialist skills combined with an ability to apply these skills to new ideas and solve problems. Other researchers emphasise the distinction between data or information workers and knowledge workers (Tjaden, 1996). While Reich (1991) categorises symbolic analysts (knowledge workers) as 'problem solvers', 'problem identifiers' and 'brokers', Davenport *et al.* (1996) classify jobs in terms of finding, creating, packaging and assembling, applying and reusing knowledge.

The reasons for organisations' growing dependence on knowledge workers who supply their know-how can be traced through a number of trends. According to Neef (1998), the globalisation of the economy, which is putting terrific pressure on firms for increased adaptability, innovation and process speed, has caused organisations to recognise and rely on the importance of their employees' skills and know-how. Secondly, there is awareness of the value of specialised knowledge, as embedded in organisational processes and routines, in coping with the pressures of globalisation. Thirdly, there is the recognition of knowledge as a distinct factor of production (Drucker, 1993) and its role in growing book value within knowledge-based industries (Neef, 1998). As a result, the fresh realisation of shifting values and norms, and the need to design new organisational structures, performance

evaluation systems and reward systems all have major implications for strategic human resource management in knowledge-intensive organisations. Thus, managing knowledge in knowledge-intensive companies requires the participation of 'knowledge creating crews', which include front-line employees (knowledge practitioners), middle managers (knowledge engineers) and top managers (knowledge officers) (Nonaka and Takeuchi, 1995).

The overall effect of these trends is to shift the institutional setting for knowledge work away from the profession or discipline towards the organisationally-defined context of use (Gibbon *et al.*, 1994). As an increasing number of organisations develop KM initiatives, evidence is accumulating that human resource issues play a critical role in achieving success. There is widespread agreement that focusing on ICT-based tools and systems alone cannot produce successful KM. The vital contribution made by HR policies and practices in the areas of rewards, culture and organisational development need to be more widely recognised. However, very few studies to date have examined the extent to which HRM practices are found in, or are suitable for, KIFs generally (Keegan, 1998). Thus, in understanding the managerial issues of knowledge workers, this research adopts the perspective suggested by Scarbrough (1999a: 7) in describing the nature of knowledge work. According to him, "knowledge work is less a matter of the application of predefined expertise and more a joint product of human interactions with informational and intellectual assets delivered through ICTs". Although there is a lack of understanding of KM-focused HRM, a number of other KM-related managerial concepts have been researched. These activities included knowledge

creation (Nonaka and Takeuchi, 1995), knowledge integration (Matusik and Hill, 1998; Gant, 1996), organisational activities and routines (Leonard-Barton, 1995), KM performance evaluation (Ecceles, 1991; Miller and Wurburg, 1998; Ware and Degoey, 1998). These following sections will examine the studies in details.

2.2.2.6.4 Knowledge Creation

The process of knowledge creation has been studied by a number of researchers (e.g., Argyris, 1978; Senge, 1990; Handy, 1989; Leonard-Barton, 1992; Nonaka, 1994). Leonard-Barton (1992) focuses on knowledge creation from an innovation perspective. She is primarily concerned with "innovation within and between groups of people" rather than individual creativity or the manipulation of knowledge objects. She identifies a number of techniques or practices as important for creating collective, tacit knowledge during innovation. These include ideation, empathic design, apprenticeship and emergent understanding involving people working together to share and develop collective tacit knowledge. She recognises the importance of treating tacit knowledge as a social process. In particular, she emphasises the use of metaphors in setting common directions for employees. Leonard-Barton argues for the right balance of cohesiveness and diversity or 'creative abrasion' – the meeting of minds on common ground to explore and negotiate their differences, generating new ideas in the process (Leonard-Barton and Sensiper, 1998).

Nonaka and Takeuchi (1995), on the other hand, suggest that knowledge creation takes place in organisations mainly because of the latter's ability to articulate and amplify the knowledge created by individuals (Nonaka, 1994; Nonaka and Takeuchi, 1995). Nonaka (1994) provides important insights as to how learning can result from mixing knowledge bases. An organisation, rather than being seen as an information-processing entity, must be considered a knowledge-creating company. According to Nonaka and Takeuchi (1995), knowledge creation is a process whereby knowledge is converted into different forms (i.e. from tacit to explicit and vice versa). This conversion process takes place within a framework of four main phases of activities that are situated within groups of individuals in the organisation: socialisation, externalisation, combination and internalisation. These reflect the dynamic interaction between and among individuals and groups at various levels of the organisation, resulting in a spiral effect of knowledge accumulation. In other words, Nonaka (1994: 20) "knowledge creation centres on the building of both tacit and explicit knowledge and, more importantly, on the interchange between these two aspects of knowledge".

Nonaka and Takeuchi (1995) also stress that the knowledge base of an organisation plays a key role in the interaction between an organisation's processes and its project teams, as is evident in their discussion of how knowledge is created in Japanese companies. Processes that support the knowledge creation spiral are described as a 'middle–up–down' management style. However, they fail to describe in any detail how middle management facilitates knowledge-sharing and -creation activities. They contend that 'teams' are the main structural components which act

as agents of knowledge creation and conversion within the existing traditional, hierarchical boundaries. They fail to distinguish why, when and how organisations rely upon specific types of teams, however. Moreover, they do not explain how the roles of the teams in the knowledge creation and conversion processes differ from the more traditional roles.

2.2.2.6.5 Knowledge Integration

From a KBV perspective, a firm is considered to be a social entity that provides opportunities for knowledge integration in utilising resources. Such a view points to the importance of understanding knowledge integration, in particular the efficiency of the internal integration of knowledge in the firm. Firms use formal and informal integration mechanisms in order to facilitate the transfer of existing knowledge to different areas of the firm and to simulate the creation of new firm-specific knowledge (Matusik and Hill, 1998).

Previous research has highlighted the importance of integrating mechanisms for disseminating knowledge within the boundaries of the firm (e.g. Moenaert and Souder, 1990; Pisano, 1994). Teams, feedback mechanisms, rewards for integrating information, advice networks, co-operative behaviour and inter-functional climates have all been examined as knowledge-integrating mechanisms (Hamel, 1991; Levinthal and March, 1993; Lyles, 1988; Nonaka, 1994). Grant (1996a) argues that it is not the transfer of knowledge, but rather, the integration of knowledge, that poses the major problem for organisations: transferring knowledge is not an

efficient approach to integrating knowledge. If production requires the integration of many people's specialised knowledge, the key to efficiency is to achieve effective integration while minimising knowledge transfer through cross learning by organisational members. Grant (1996a) is primarily interested in the knowledge application of firms, and does not deal with the more dynamic aspects of knowledge creation. He suggests three mechanisms for integrating specialised knowledge in a firm: rules and directives; sequencing; and group problem solving and decision-making. All three rely on the existence of a common language in the organisation for their operation. In his view, the mechanisms of knowledge integration and common knowledge are both subject to the important distinction between tacit and explicit knowledge.

Integration mechanisms are also necessary for a firm to accumulate external knowledge outside its boundaries (Matusik and Hill, 1998). Examples of such mechanisms cited in previous studies (Hamel, 1991; Pisano, 1994; Moenaert and Souder, 1990) include: boundary spanning positions, resources committed to attaining information, formal strategy toward knowledge acquisition and rewards for attaining information.

2.2.2.6.6 Other Knowledge Processes

A number of studies have explored other aspects of the knowledge process, including knowledge acquisition, storage, identification, retrieval and utilisation. For example, Walsh and Ungson (1991) demonstrate how processes of information

acquisition, retention and retrieval contribute to a firm's organisation memory. Scarbrough *et al.* (1999a) argue that, through codification processes, knowledge is made communicable, and knowledge of organisations is retained. Hansen (1999) explores how knowledge's search and retrieval processes influence the innovation capacity of firms. Hargadon and Sutton (1997) analyse how design consultants act as technology brokers using routines of knowledge acquisition, storage, retrieval and generation. Other KM researchers have described the storage of knowledge as the process through which organisations 'put away' information for later use (Walsh and Ungson, 1991; Huber, 1991; Hargadon and Sutton, 1997). Balasubramanian (1995) suggests that the access and further development of skills, insights and relationships play a critical role in the successful dissemination of learning; Ruggles (1997) notes that knowledge interchange involves transfer and assimilation. He further suggests that organisations synthesise, adapt and transform knowledge in order to generate new knowledge. Other 'descriptors' of knowledge processes include: 'appropriation' (Orlikowski, 1992); 'search' (Hansen, 1999); 'access' (Nahapiet and Ghoshal, 1998); 'assimilation' (Balasubramanian, 1995); and 'retention' (Scarbrough *et al.*, 1999).

2.2.2.6.7 Organisational Activities and Routines

Leonard-Barton (1995: 8) suggests that "knowledge building for an organisation occurs by combining people with distinct individualities with a particular set of activities". In particular, researchers have increasingly drawn attention to the links between learning orientation (Nevis *et al.,* 1995), knowledge (Nonaka, 1994), and

learning and actual firm performance. In particular, one stream of learning studies has examined the relationship between knowledge activities and learning. For example, Nonaka (1991) and Boisot (1987) have contributed new approaches to the learning literature. Nonaka concludes that the use of figurative language, symbolism and metaphors develops an individual's tacit or explicit knowledge. These knowledge creation tools may aid an organisation during phases of innovation but may have their limitations during phases of efficiency (Miller-Hosley, 1994). On the other hand, Boisot (1987) believes that organisations learn through a process of organisational knowledge creation (codification) and distribution (diffusion).

Researchers have also studied organisational activities as ways of understanding knowledge and learning. For example, studies have been based on an 'activity system' which focuses on organisational activities as a way of understanding organisational learning and knowledge (see Blackler, 1995; Nonaka and Takeuchi, 1995; Leonard-Barton, 1992; Lowendahl, 1997; Orr, 1990). Nonaka and Takeuchi (1995), in their work on innovation in Japanese companies, regard learning as an evolving and developing process which articulates explicit and tacit knowledge in a spiral style.

Leonard-Barton (1992) studied activities at different levels of an organisation and described how the organisation evolved and became a learning laboratory. She suggests that learning requires the creation and control of both external and internal knowledge, problem-solving and continuous innovation for both current and future

operations. On the other hand, in order to deal with the problems of 'statics' associated with Blackler's taxonomy, Spender (1996) also uses activity as a central concept to account for the dynamics of organisational knowledge. He argues that activity systems embrace individual and collective knowledge, both explicit and implicit. In his view, the key is the dynamic that leads to changes in the various types of knowledge, and in the learning and 'unlearning' processes.

Another important aspect of KM activities is the role of 'routines', a term which emerges from the RBV literature. Nelson and Winter (1982) consider behavioural routines as the very essence of the organisation, acting as the means by which organisations produce predictable results while adapting social and technical changes. They suggest that "reliable routines of well-understood scope provide the best components of new combinations". In this regard, Levinthal (1991) states that success at the innovative frontier may depend on the quality of the support from the civilised regions of established routines. Building on Nelson and Winter's (1982) work, Amburgey *et al.*, (1990) suggest that learning processes enhance an organisation's ability to change. They argue that the more standardised routines become, the more readily innovation may occur through the recombination of existing routines.

2.2.2.6.8 Knowledge Management Performance Evaluation

Despite the growing interest in the role of knowledge workers, the specific question of the performance evaluation of knowledge workers is missing from the literature.

Most of the literature has been devoted to examining the effects of intra-organisational processes and inter-organisational linkages on the management of knowledge. For example, Leonard-Barton (1995) discusses the importance of employee knowledge and skill in transforming organisations into 'wellsprings of knowledge'. However, the details of what constitute employee knowledge and skill is not taken into account. Similarly, Nonaka and Takeuchi's (1995) work emphasises team dynamics rather than individual activities in organisational knowledge creation.

Even with the increasing interest in organisational knowledge, most management researchers and practitioners do not seem to have taken seriously the processes of capturing, measuring and managing intellectual capital (Roos and Roos, 1997). One of the most difficult aspects in organising knowledge-related activities is to provide accurate and reliable assessments of knowledge worker performance. The current literature suggests several reasons why this task is difficult (Gregerman, 1981; Nomikos, 1989; Ware and Degoey, 1998): the problem of quantifying the output of knowledge workers; the problem of measuring the contribution of knowledge workers over time; the problem of separating the contributions of individuals from those of a team; the resistance to the measurement of knowledge workers' performance. Moreover, according to Miller and Wurzburg (1998), three substantial barriers stand in the way of more efficient approaches to measuring and valuing human resources in knowledge-intensive activities:

- A lack of transparency in the costs of labour

- The difficulty of measuring the productive capacity – the knowledge, skills and abilities – that workers acquire through further training and/or experience on the job
- The problem of reflecting a realistic economic value for organisations

In an attempt to address these difficulties, Eccles (1991) suggests using qualitative performance measurements, including innovation, personnel and customer satisfaction, in addition to financial evaluation. Building on this work, Kaplan and Norton (1992) introduce the 'balanced scorecard' technique to assist managers in combining performance measurements from different perspectives (i.e. the infrastructure perspective, customer perspective, financial perspective, and knowledge development perspective). Other researchers have also attempted to measure competencies (Klavans, 1994), technological knowledge (Bohn, 1994) and the meaning of employee-knowledge and other 'intangible resources' (Hall, 1994).

2.3 The Lessons Learned: A Synthesis

As this review has shown, there is certainly no shortage of opinions and theories about KM. The field of KM brings together a range of different issues, including the economics of knowledge, the emergence of knowledge as an important resource, learning, cognition, the taxonomy of knowledge, the use of ICT, and strategic management of knowledge. As Spender (1996: 66) observes, the fragmentation of the organisational knowledge literature is the result of "methodological manoeuvres institutionalised into the contemporary analysis of organisational knowledge".

Firstly, there are few theoretical developments that illustrate how knowledge-sharing activities are organised in organisations. In particular, it is clear that there are a number of distinct disciplinary perspectives to organisational knowledge, and each of these has its own ontology and epistemology. The application of these disciplinary perspectives leads to distinct theoretical problems concerning the nature of KM studies. The literature can be arrayed to form a continuum, from what can be termed 'content' theory to 'relation' theory (Scarbrough, 1996). At one extreme, knowledge is considered as an objective entity that is acquired by individual learning and is embodied, owned and controlled in a variety of forms. At the other extreme, knowledge is shaped by patterns of social relations. The present research proposes an integrated view of the social and technical elements so that the critical issues of the organising knowledge sharing process can be captured and analysed even-handedly.

Secondly, the review shows that organising knowledge sharing can be seen as a joint function of social, managerial and informational technology mechanisms. A social-technical perspective study of ICT is not entirely new. Previous studies, such as those by as Orlikowski and Gash (1994); Zuboff (1988) and Orlikowski (1992), argue that the success of the organisational use of ICT is very much dependent upon the enactment of individual and collective elements that are embedded in the organisation. What is new in the present research is that it aims to take the KM debate further by moving towards a virtual community-based approach. In other words, it attempts to situate the social-technical view of organising knowledge sharing in CoPs instead of within the traditional organisational boundary in general.

The research is thus mainly concerned with marrying the socio-technical perspective and the concept of 'community of practice' (Brown and Duguid, 1991). This is a connection that few previous KM researchers have pursued.

Thirdly, despite the growing popularity of the area of KM, there remains a lack of attention to the human resource-related issues of knowledge workers. In particular, to date, very few in-depth studies regarding a KM-focused HRM of knowledge workers have been conducted (Despres and Hiltrop, 1995). The management of knowledge workers is a complex task that requires new managerial skills. The nature of knowledge-based work is fundamentally different from what was known about organisations and requires a different order of thinking (Despres and Hiltrop, 1995). The research suggests that a KM-focused HRM could play a co-ordinating role in blending various dimensions of the knowledge-sharing context. Therefore, a better understanding of a KM-focused HRM is necessary.

Fourthly, in proposing a socio-technical perspective on KM, this study is also seeking to respond to a variety of theoretical, empirical and methodological considerations. Four factors in particular seem to warrant such a perspective. First, despite the growing tendency to emphasise the role of information technology in KM, an increasing number of studies (Spender, 1996; Starbuck 1992) provide powerful arguments for a more holistic view which recognises the interplay between social and technical factors. Secondly, there is the point made by Kogut and Zander (1992) which re-focuses attention on the work process itself: "it is in the regularities of the structuring of work and the interactions of employees

conforming to explicit and tacit recipes that one finds the content of the firm's know-how". Thirdly, according to Grant (1991), compatibility between social and technical subsystems is the key to meeting the needs of customers and hence enhancing the competitive position of the firm. It follows that adaptations to new information technologies (such as knowledge- sharing systems) inevitably require a redefinition of the relationship between the environmental and technical subsystems through a series of organisational changes (Shani and Sena, 1994). Finally, not only does a socio-technical perspective reflect these theoretical and empirical factors, it also provides a suitably synthetic analytical space for considering technological and social factors in a symmetrical and even-handed way, thereby avoiding the pre-emptive implications of approaches based on over-theorised epistemological positions.

Finally, drawing on various KM perspectives (both macro and micro), two research questions emerged to form the foundation of the empirical study of the dissertation: what are the mechanisms involved in organising knowledge sharing activities over time and how are the mechanisms for organising knowledge sharing interrelated over time? The two main research questions were derived from the above-discussed theoretical perspectives (see Figure 2-2). The questions are both theoretical and empirical, inasmuch as the two aspects are tied together by the objectives of this study. The research questions are built upon the strengths and weaknesses discussed within the existing perspectives on managing knowledge in organisations. The findings of this study aim to fill important gaps in the existing literature.

2.4 Conclusion: Towards a Socio-technical Perspective of Organising Knowledge Sharing

In outlining a socio-technical perspective on KM, this study aims to recognise the limitations of the STS approach while applying its potentially powerful analytical tools to the contemporary issues created by the management of knowledge – notably, the issues of valorising tacit knowledge through the application of ICT. Therefore, instead of attempting to create a new socio-technical theory, the focus of this research is on providing a useful analytical framework for examining the organisation of knowledge sharing from a socio-technical perspective. Building on the spirit of socio-technical systems theory, a binocular focus on social and technical subsystems implies that a delicate balance between the selection of new information technologies must take into consideration the existing social subsystems and the need to change those subsystems to accommodate the requirements of knowledge sharing. Therefore, by adopting a socio-technical approach, as Scarbrough (1996: 32), puts it, "this means reframing the content and relational aspects of knowledge in terms of the social processes and structures through which knowledge is constructed" (Scarbrough, 1996: 32).

The research considers knowledge to be inscribed in the conversations and social interactions within communities as well as being a resource that is disseminated via ICT. In other words, this study aims to contribute to the existing knowledge by moving our understanding of knowledge as a resource, and knowing as a socially constructed process to knowledge as an outcome of the interplay between social

and technical contexts in knowledge sharing activities. Such an objective also coincides with Scarbrough's (1995) call to provide true socio-technical accoounts.

According to him, "In the age of IT, the need for a powerful account of what are truly socio-technical phenomena may be greater than ever" (p. 31). In order to fulfil this task, as Pava (1986) observes, a new set of important targets such as extended information systems and inter-functional activities are required. Scarbrough (1995) argues that one can still argue a case for socio-technical thinking as a powerful language for understanding and addressing practical concerns (Morgan, 1986). Hence, this research engages in the debate over theories of IT, KM, and the value of the concept of CoP.

By integrating the socio-technical concept and the CoP notion, a holistic approach emerges which highlights the interweaving of social and technical factors in the way people work within virtual communities. It also underlines the complex interactions which take place between the subjective perceptions of employees and the objective characteristics of work processes. Building on the previous basic precepts (e.g. the open systems approach, the ideal of the best match and alternative principles of redundancy), our view of knowledge sharing emphasises its concern with the subtle and diffuse structuring of behaviour and perceptions arising from information flows and communication systems (Scarbrough, 1995).

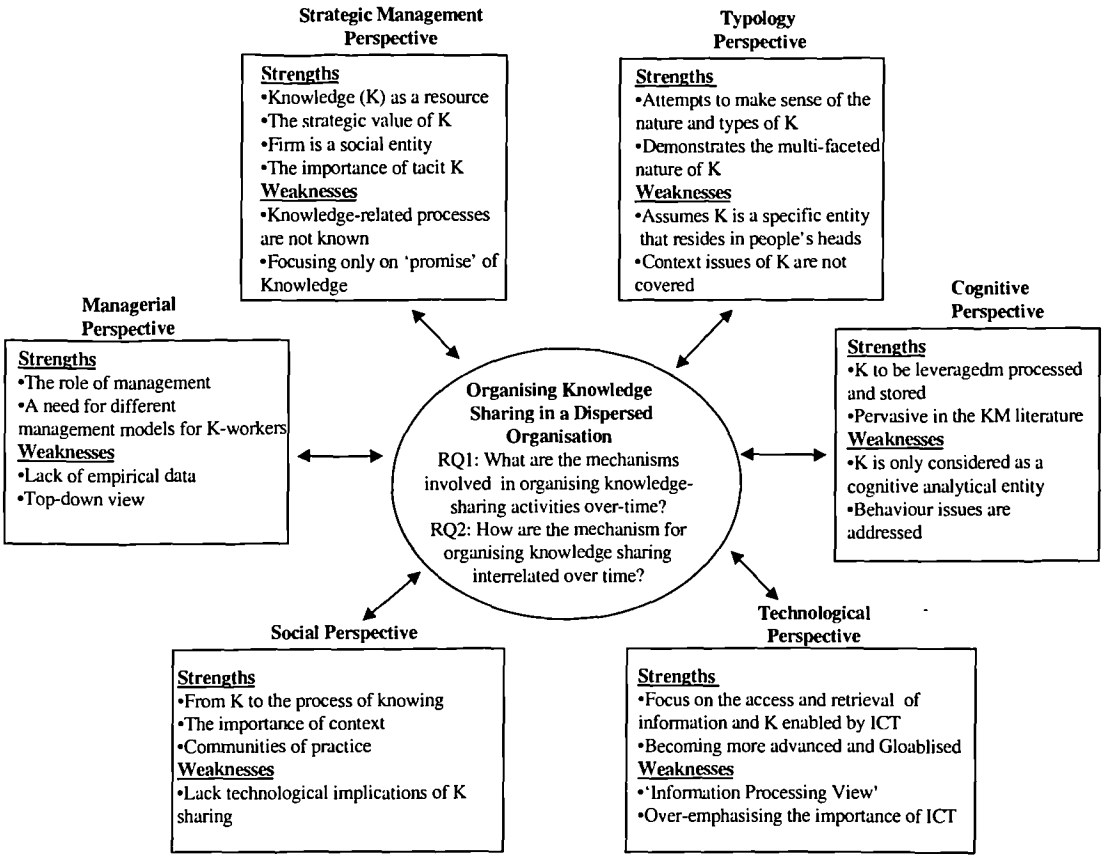

Figure 2-2: Strengths and weaknesses identified from the review of literature

Finally, in this review, a multi-disciplinary theoretical approach to the study of the organisation of knowledge sharing is posited. The contribution of this chapter is two-fold: First, it presents the current directions of research in the area of organisational knowledge. It identifies a shift in KM research away from a cognitive, resource, technical and functionalist approach towards a view of knowledge activities as socially constructed and community-based. The critique of the existing approaches leads to a socio-technical perspective being adopted in this

research. This perspective is systematically classified to be within the interpretive paradigm of Burrell and Morgan (1979).

Secondly, through the review of relevant literature, it is clear that the use of a socio-technical perspective for understanding knowledge sharing is still at a theory-building stage. This highlights the need for more empirical research to identify the mechanisms and processes of knowledge sharing.

3 Chapter Three: Research Methodology

3.1 Introduction

This chapter outlines the methodology adopted in this research as a basis for examining organisational knowledge sharing. Here methodology does not refer only to a format for carrying out the research; it also provides a means of constructing a dialogue between theory and practice. Moreover, the paucity of prior theoretical and empirical research on this topic makes it necessary to go into the field to observe organisational efforts as a means of advancing our understanding of KM.

Buckman Labs has been selected as a case study of a distinctive organisation whose purpose is to facilitate knowledge sharing for competitive advantage. Hopefully this study will help to bridge the gap between conceptual research and organisational practice. Consequently, the general approach of this study is interpretative in character, with qualitative research methods being employed to explore and explain the central research questions.

The chapter is divided into seven sections. After the introduction, section 3.2 focuses on the epistemological underpinnings which inform the research, reviewing the contribution of the interpretative approach to social science and demonstrating

the role of interpretative research in the theory-building process. Sections 3.3, 3.4 and 3.5 present the study's detailed research strategies and methods. Relevant steps and procedures that were used to collect and analyse data are also identified and explained. Section 3.6 presents the researcher's personal reflections on the distinctive features of the methodology being used. Section 3.7 summarises the research contributions and provides some concluding remarks.

3.2 Epistemological Foundations

A significant proportion of social science research is based on the distinction between qualitative and quantitative methods. The prevalence of academic debates between interpretative ethnographers and positivistic scientists (Robson, 1993) can be seen as evidence of the pervasiveness of this rift today. Instead of engaging in further debate (see Bryman, 1984; Denzin, 1989; Silverman, 1993) between the two schools of thought, this chapter aims to follow Bryman *et al.*'s (1988) and Robson's (1993) approaches in avoiding a fixation with what does or does not constitute 'scientific' research. Rather, the present section briefly examines the differences between interpretative and positivistic approaches in social science research. Against this backdrop, methodology is discussed with a view to best equipping the researcher to investigate the research phenomenon of organising knowledge sharing.

In most social science research, the epistemological foundations of quantitative and qualitative methodology can be considered as respectively nomothetic and

ideographic in nature (Burrell and Morgan, 1979; Luthans and Davis, 1982). According to Burrell and Morgan (1979), nomothetic approaches focus on the process of testing hypotheses with scientific rigour. These approaches construct scientific tests and use quantitative techniques for data analysis. Ideographic approaches argue that the subject should be allowed to reveal its nature and characteristics during the process of investigation. This approach is based on the view that organisations and the social world can only be understood by obtaining first-hand knowledge of the subject under study (Burrell and Morgan, 1979).

While some authors reject the distinction between quantitative and qualitative approaches (e.g. Dabbs, 1982; Bryman *et al*, 1988), Silverman (1993) argues that the former may be seen as an expression of positivism, while the latter is an expression of interpretative social science. Positivism utilises the concepts of structure, facts and quantitative hypothesis testing, while "interpretative social science views reality as a social construction, being primarily concerned with meanings and therefore qualitative hypothesis generation" (cited in Bartlett and Payne, 1997, p. 173).

Generally, qualitative research can be characterised as the attempt to obtain an in-depth understanding of the meanings and definition of the situation presented by informants, in contrast to the production of a quantitative measurement of their characteristics or behaviour. A concern to reveal the subjective beliefs of those being studied is common to ethnography, direct observation, and the various other strands of qualitative research.

In making a choice of methods for the present research, it is clear in the researcher's mind that no single research methodology is intrinsically better than any other (see, for example, Benbasat *et al.*, 1987). Indeed, some authors call for a combination of research methods in order to improve the quality of research (e.g. Kaplan and Duchon, 1988). The researcher was determined to avoid the practice of methodological monism, i.e. the insistence on using a single research method. This is not due to an inability to judge the advantages and disadvantages offered by different methodologies. Rather, the researcher recognises that all methods are valuable if applied appropriately and that research can in fact include elements of both positivist and interpretivist approaches. After much careful thought, it was decided that an interpretative case study approach should be adopted in the present research. As the researcher set out to trace the interactions between organising knowledge sharing practices and the organisational context, he decided to approach the phenomenon from a multi-layered and multi-faceted perspective. It therefore seemed obvious that a mix of qualitative methods was essential, to include a case-study method, on-site observations (at the case site and through on-line participation in the case company's Intranet), and grounded theory. In other words, the study can be characterised as a multi-method, in-depth field research study (Snow and Thomas, 1994).

3.2.1 The Rationale for Choice of Methodology

In recent years, qualitative methodology has been accepted as a robust source of knowledge and has been seen as the optimal approach to some organisational issues

(Yin, 1994; Miles and Huberman, 1994). It is also recognised as "a set of methods which permits the evaluator to study selected issues in depth and detail" (Patton, 1990, p. 3). It is not philosophical nuance that should drive the choice of methodology but the content and form of the research questions and the context of the research phenomenon (Miles and Huberman, 1994).

As pointed out by Van Maanen (1979), if a certain proportion of a temporal and spatial domain of social reality is taken as the territory for the research, the chosen methodology can be seen as a map with which the territory may be interpreted or 'read'. Accordingly, this study suggests that a methodological choice is determined to a great extent by the purposes and the characteristics of the research. In this case, the study of the organisation of knowledge sharing seeks to analyse a phenomenon in its natural environment (i.e. through on-site and on-line observation). In other words, this approach emphasises the importance of getting closer to the subject and exploring in detail its history and background. This orientation also encourages the researcher to become involved with the everyday practices of the organisation and to develop insights about the subject in context.

The interpretative research methods that have been suggested in the literature include interpretative in-depth case studies (Walsham, 1995), grounded theory (Glaser and Strauss, 1967), ethnography (Harvey and Myers, 1995), phenomenology (Boland, 1985), hermeneutics (Lee, 1994), and critical hermeneutics (Myers, 1995). In particular, Lee (1991) suggests that the interpretative approach is associated with "ethnography, hermeneutics,

phenomenology, and case studies, whereas the positivist approach refers to procedures associated with inferential statistics, hypothesis testing, experimental and quasi-experimental design" (p. 342). This strict categorisation, although useful as an initial understanding, is problematic. According to Visala (1991), it is possible to have case studies which are positivist (e.g. Yin, 1989) or interpretivist (e.g. Walsham. 1993), and mathematical analyses or statistical methods can be used in interpretivist research (e.g. Kaplan and Duchon, 1988). Hence, it is agreed that both positivist and interpretivist research aim at improving the understanding of phenomena, but differ in how this can be approached (Myers, 1997).

3.2.2 Interpretative Study and Knowledge Management Research

In recent years there has been a growing interest in interpretative methods and their application to information systems (Orlikowski and Baroudi, 1991). Landry and Banvile (1992) suggest that no single method could ever capture all the richness and complexity of organisational reality, and that a diversity of methods, theories and philosophies is required (p. 78). The interpretative approach is considered applicable in real-life situations when complexity prevents replicability and statistical significance testing in the positivistic sense (Myers, 1997).

The organisation of knowledge sharing is the result of a combination of, and interplay between, several causes. This therefore requires the analysis of the organisational contexts of knowledge-related practices, with the notion of context drawing on the framework provided by the social construction of meanings.

Although interpretative research is relatively new to the KM field, it offers an opportunity to conduct rigorous research that is of direct practical relevance. In line with the call for methodological pluralism in KM (Spender, 1996), interpretative research methods have also gained prominence in the information systems area. One plausible reason for this is the general shift in KM research away from a purely IS or IT focus to a greater concern with managerial and organisational issues (Alvesson, 1993; Starbuck, 1992). This in turn reflects the desire to study KM-related problems in the richness of their real-life setting as opposed to the artificial context of laboratory studies, and the required ability to address issues of causality and human purpose in their complex reality (Myers, 1994).

3.2.3 Modification of the Chosen Methodology

Having decided on the use of a qualitative approach, a decision had to be made about what specific methods should be employed in seeking to understand the social world and the context of KM. As noted in the literature review, there has generally been an over-emphasis on the importance of a systematic IT protocol, technique and the nature of knowledge. The KM domain presents a rich source of behavioural issues that have not yet been understood. Therefore, efforts were made to identify research methods that would be relevant to the overall research question and rigorous in their operationalisation.

However, despite having demonstrated the connection between the interpretative case study methodology, the requirements presented by the research objectives and

the socio-technical approach, the researcher could not simply borrow the standard case study designs proposed by qualitative researchers (Eisenhardt 1989, Yin, 1994). More importantly, the choice of methodology should reflect and implement an underlying epistemology. As the present study uses interpretivism as its epistemology, its orientation needs to be different from the orientations employed by positivists, conventionalists, realists and constructivists. Thus, the distinctive features of this qualitative case study will now be explained.

First, the research deliberately seeks to avoid imposing a theoretical framework of meanings and definitions, and entails detailed observation and interaction within the organisation being studied. Instead, the issue of contextualising the process of knowledge sharing within the organisation is vitally important in the present study. To understand fully the context-dependent KM practices, the research methodology employs a combination of qualitative methods with an emphasis on triangulation and reflexivity. The semi-structured interview and on-site observation are the main techniques used for data collection. Given the complexity and exploratory nature of this research, a reflexive approach is essential. Its advantage is that it allows for refocusing and changes as the research progresses. Thus, by means of a reflexive approach, the researcher can use answers to interview questions to modify the structure and content of later interviews.

Secondly, by combining longitudinal study with qualitative research methods, and by adopting the rationale with the intuitive approach to knowledge, the focus is on the unfolding of the process rather than the structure (Hari Das, 1983). The

emphasis is on a retrospective analysis, rather than a snapshot, of the research, thereby making it possible to obtain a 'processual' view (Pettigrew and Whipp, 1991) of the process. Process research relates antecedents (i.e., in this study, the social and technical dimensions) to outcomes (in this case, global knowledge-sharing practices). An attempt is made to develop descriptive accounts of events that are interconnected in time, and then to apply these to develop explanations (Pettigrew, 1993). One of the distinctive features of the present research design also derives from the more recent tradition of process research in strategy (Chakravarthy and Doz, 1992; Pettigrew, 1992).

3.2.4 Interpretative Case Study and Theory Building

Following the decision on what qualitative methods to use, attention was turned to the issue of how an interpretative case study can contribute towards theory building (Eisenhardt, 1989). The study argues that interpretative theory building tends to be more inductive in nature than positivist approaches. Consequently, the researcher approached the phenomenon with as few a priori ideas as possible, whereas other existing KM theories about structuring processes are often accounted for relatively late in the theory-building process. For example, in the earlier stage of the study in 1997, the socio-technical perspective was not the main focus. However, after the initial treatment to the data, some of the emergent themes relating to the organisation of knowledge-sharing practice suggested labels from the socio-technical literature (Pava, 1986; Scarbrough, 1995). Hence, as the data collection

phase began in 1998, the interrelationships between the social, technical and managerial elements of KM practice became the focus of the study.

The core belief of theory building is that of becoming part of the evolving events being studied by observing the phenomenon from the perspectives of the organisational actors. As a result, an interpretative field research is adopted in the study because it provides a platform in dealing with actual practices in real-world situations. Moreover, in this case, relevant issues can also be explored and frameworks developed which can be used by both practitioners and researchers, enabling (as suggested by Meyer, 1997), the appreciation of organisations as complex social, cultural and political systems. In order to achieve the above-mentioned objectives, a grounded theory that is inductively derived from the study of the phenomenon it represents (Strauss and Corbin, 1990) was adopted in the study. This theory was developed as a methodology by two sociologists: Barney Glaser and Anselm Strauss. As commented by Strauss and Corbin (1990) on grounded theory approach, "its systemic techniques and procedures of analysis enable the researcher to develop a substantive theory that meets the criteria for doing 'good' science: significance, theory-observation compatibility, generalisability, reproductivity, precision, rigor, and verification" (Strauss and Corbin, 1990, p. 31).

To sum up, the theory building process in this research is as follows. First, the researcher collects relevant data and makes attempts to preserve their distinctive representations (Gioia and Pitre, 1990). This is followed by the data analysis stage,

which includes "coding procedures to discern patterns in the qualitative data so that descriptive codes, categories, taxonomies, or interpretative schemes that are adequate at the level of meaning of the informants can be established" (p.588). Thereafter, as the following sections will demonstrate, the processes of analysis, theory generation, and further data collection are typically iterative, cyclical, and non-linear. In this way, tentative themes about the structuring processes were confirmed or rejected by further discussion with informants. Subsequently, "corrections, revisions and modifications are likely to occur before a grounded, substantive, mid-range theory is proposed (Gioia and Pitre, 1990, p. 588).

3.2.5 The Use of Case Study

After explaining the selected methodology, methods, and theory-building process of the study, the following section considers the advantage of using the case study method. The distinctive strength of a case study is its ability to deal with a variety of evidence, documents, questionnaires, interviews and observations. In particular, in exploring an emerging field and its unknown practices, as in the example of KM, a case study method seems highly appropriate.

Generally, an exploratory case study is used as a precursor to further quantitative data collection and analysis (Benbasat *et al*; 1987). Case studies are deemed to be particularly good for answering the 'how' and 'why' questions (Yin, 1989). Yin (1989) defines case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context in which the boundaries between

phenomenon and context are not clearly evident, and when multiple sources of evidence are used. The case study is also recognised an appropriate method of empirical inquiry when the phenomena to be studied cannot easily be separated from their organisational context (Yin, 1989). In particular, it is most useful for understanding the interactions between information technology-related innovations and the organisational context (Darke *et al.,* 1998). Case study research has been used within both the positivist and the interpretivist philosophical traditions (Cavaye, 1996; Doolin, 1996). As already explained, the positivist perspective is founded on an ontology in which an objective physical and social world exists independently of humans' knowledge of it. The interpretative paradigm is based on the views that people socially and symbolically construct and sustain their own organisational realities (Berger and Luckmann, 1966; Morgan and Smircich, 1980). In other words, the strength of analysis in interpretative studies derives from the strength of the explanation of the phenomena based on the interpretation of data (Darke *et al*; 1998). Such a process also relies heavily on the researcher's interpretation of events, documents and interview material (Galliers, 1992).

However, the case study approach is not without problems and criticisms. In particular, the issue of generalisation has led to a common criticism of the approach, because it has been argued that its research results are not universally applicable. However, Yin (1984) refutes that criticism by stressing the difference between analytic generalisation and statistical generalisation: 'In analytic generalisation, previously developed theory is used as a template against which to compare the empirical results of the case study' (p. 45).

3.2.6 The Use of a Single Case Study

The empirical part of this research project consists of a single case study that investigates the complex social phenomenon of managing intra-corporate knowledge. Yin (1989) differentiates between two versions (critical and extreme) of the single case study according to the specific level of the unit of analysis. This case study focuses on the case organisation as a single, global level, and is thus 'holistic' (Yin, 1989). This typically refers to a case study of an institution as opposed to the analysis of the functioning of the separate sub-units within the institution.

The usefulness of a single case study is highlighted by Dyer and Wilkins (1991), who state that the focus on building and testing general constructs in multiple cases can harm the visibility of the interrelations with the context of a particular setting. In fact, a single case study can give more attention to the distinctive and typical characteristics of a particular social scene, and can reveal the deep structure of social behaviour. Moreover, in Yin's terminology (1989), the single case study design is eminently justifiable in this particular situation because the case serves a revelatory purpose. The observation of, and insights into, issues surrounding intra-corporate knowledge sharing in this particular organisation should amount to a significant empirical contribution.

Since the research topic is relatively new, and in-depth data is required for a broad range of variables, a single case research approach may be considered appropriate.

Moreover, a single case design is particularly suitable where the case reveals a previously inaccessible phenomenon (Ellram, 1996). According to Yin (1994), "it is appropriate where it represents a critical case, where it is an extreme or distinctive case, or where it is a revelatory case" (Yin, 1994, pp. 38-40).

Therefore, by adopting an approach taken by Levy (1988), this research employs a single in-depth case study as there has previously been very little literature relating to KM implementation within a knowledge-intensive firm over time. The use of a single case study as a basis for drawing inferences about a particular area of study stems from an interpretative epistemological stance (Walsham and Waema, 1994; Craig Smith, 1989; Orlikowski and Baroudi, 1991). These researchers argue that the value of one or more cases depends on the plausibility and cogency of the logical reasoning used in describing the results. Hence, as far as this study is concerned, an interpretative analysis is "an induction, guided and couched within a theoretical framework, from the concrete case situation to the social totality beyond the individual case" (Walsham and Waema, 1994, p. 151).

3.3 Phase One: Research Design—Preparation Phase

3.3.1 Research Site Selection

Choosing an appropriate site to study and forge a relationship with its participants is a key issue for all qualitative case studies. Ward-Schofield (1993) explores the consequences of site selection for validity and generalisability, and suggests that

both can be maximised either by selecting a typical site or else conducting a multi-site study. On the other hand, Wainwright (1997) argues that it is the potential to access the authentic views of the informants that guide the researcher's selection of a site, rather than the largely unattainable goal of being representative. As the context for qualitative research is infinitely variable, the characteristics of an ideal site cannot be predicted in advance; hence the need for reflexive management by the researcher.

Buckman Labs was selected as a company that has been identified as a knowledge-intensive organisation (Zack, 1999). It thus offers the opportunity to counteract the previous over-theorising of KM. This is because, first, Buckman Labs, unlike many other firms, is able to demonstrate important tangible benefits from the management of knowledge, including dramatic improvements in customer response times and product innovation rates. Secondly, the pioneering efforts of Buckman management and its Chairman, Bob Buckman, underline the crucial role played by organisational factors in securing these benefits over and above the role of information technology.

3.3.2 The Design of the Case Study Protocol and the Unit of Analysis

Yin (1994, p. 64) recommends the use of a case study protocol as part of a carefully designed research project. The development of a formal protocol can provide the reliability which is required from all research (Tellis, 1997). Accordingly, the researcher developed a preliminary research protocol based on previous research

and a review of the literature, using the design suggested by Yin (1989). A case study protocol should contain not just the survey instrument but also the procedures and general rules that must be followed in using the instrument. These are:

- An overview of the project (project and case study issues)
- Field procedures (credentials and access to sites)
- Questions (specific questions that the investigator must keep in mind during data collection)
- A guide for the report (outline and format for the narrative)

An interview protocol for this research was created before the data collection phase. During the preparation phase, a number of key issues were carefully considered, including the matters of access, availability of resources, and the data collection schedule (Stake, 1995).

The study adopts a retrospective approach. It is based on a case study, interviews with persons who can provide accounts of events that preceded particular outcomes, the researcher's own observations of the firm over a short time period, and collection of secondary data on the firm as and when available (Swan and Newell, 1998). The analysis traces the change incidence retrospectively over ten years, and includes an on-site observation span over six weeks in March and April 1998.

A case study can be that of an individual in a defined context, a small group or an organisation (Miles and Huberman, 1994). The unit of analysis is a critical factor in any case study. It is typically a system of action rather than an individual or group of individuals. To explore fully the mechanisms of the knowledge sharing process, it was decided that the unit of analysis for this research would be the organisation with a strong focus on its evolution and the stimulators and inhibitors of the process of organising knowledge sharing.

3.4 Phase Two: Collection Procedures

The key advantage of interpretative case research in terms of the above-mentioned ontology, epistemology and research objectives lies in its ability to capture complex interdependencies by handling rich sources of data and multiple forms of data collection (Easton, 1995). Stake (1995) and Yin (1994) identify six major sources of evidence in case studies: documents, archival records, interviews, direct observation, participant observation, and physical artefacts. In this research, five of the six sources were used, the exception being participant observation. Designed as a single case study, the research relies mainly on information gathered in semi-structured interviews, the researcher's own on-site observations, archival material (e.g. reports, internal evaluation data, newsletter items) and externally oriented documents. Key informants associated with the social and technical aspects of knowledge sharing were interviewed.

The data collection began with a review of publications by 'outsiders', providing perspectives on the case company, the analysis of internal documents, and interviews with a selected number of corporate managers, middle managers, front-line managers and associates.

3.4.1 Access and Front-end Management

As Shaffir *et al.* (1980) suggest, one central problem shared by all field investigators is the problem of gaining access. "Negotiating access to organisations for the purposes of research is a game of chance, not skill" (Buchanan *et al,* 1988, p. 56). The ideal research setting is one in which the observer obtains easy access, establishes an immediate rapport with informants, and gathers data directly related to the research (Taylor and Bodgan, 1984). Indeed, in this case the standard of data collection relied on the uniformly high quality of access negotiated with the organisation under study.

3.4.1.1 The First Stage of Access Negotiation

The first step in the data collection process involved gaining access to Buckman Labs by contacting its top management to solicit participation. Given the difficulties involved in gaining access, the researcher resorted to a relationship model and maintained flexible entry tactics and strategies (Shaffir *et al.*, 1980). Through reviews of the literature, Buckman Labs was identified as a potential case company for in-depth study. The overall strategy of gaining access was two-fold.

First, the immediate aim was to identify key players in the context of knowledge-management initiatives. Taking a rather different approach from the "contacting middle management" strategy proposed by Buchanan *et al.* (1988), an e-mail was first sent to the Chairman of the company—the "gatekeeper", to use Becker's (1970) term—expressing an interest in learning more about Buckman Labs' KM experience. Then, after a preliminary study of the company was made, access issues were proposed and negotiated.

Initially, in the early stage of the preliminary study, some e-mails were exchanged with the Chairman and a "snowball" sampling method was applied to generate a list of key guides and informants for further contacts. After the initial contacts with the Chairman, he selected 15 employees for the first stage of the study. The initial 15 key informants approached in the case company included either the Chairman or a member of the top management team and the Vice President of the Knowledge Transfer Department. During this phase, unstructured interviews and discussions through a total of 150 e-mails were conducted. Although the strategy of obtaining an initial list of potential interviewees from the Chairman might be seen as biased and problematic, this list of names was used a starting point rather than as a final, definitive guide to research. Moreover, the suggested lists of projects and key informants were triangulated via multiple checking to assess whether they were seen as representative by other interviewees.

3.4.1.2 The Second Stage of Access Negotiation

Secondly, after the preparation phase, a face-to-face meeting with the Chairman of Buckman Labs was arranged. An official research proposal was presented to the Chairman and a company consultant to outline the aims and intentions of the research study. In negotiating access to observe the KM practice on-site, a number of key questions were raised and discussed, including the duration of the study, the nature of observation (overt or covert), the involvement of the management, and the publication rights to the company case study after the research.

3.4.2 Front-end Management

Although the method of collecting information via e-mails is not considered as a standard practice in qualitative research, it proved to be a highly efficient method of collecting preliminary data in the present case. It also provided a valuable insight into how people relate to one another (Taylor and Bogdan, 1984). Another advantage of exchanging e-mails during the preparation period was that it helped to establish contacts prior to the actual on-site data collection process. However, care was also taken by the researcher during the process not to influence the informants in ways that might distort their behaviour or testimony, especially in matters of sensitive or closely guarded information. Managing the relationship with informants, or 'front-end management', is an important aspect of the validity of any qualitative study, but it can not be prescribed as a specific procedure, and its adequacy or effectiveness is unlikely to be immediately apparent to a third party.

Meanwhile, a literature search was conducted in tandem throughout the process in order to ground the analysis theoretically (Glaser and Strauss, 1967). The information gathered was used to help generate some preliminary themes in creating the interview pro-forma, and a case background report was also written to act as a "deductive driver" (Pettigrew and Whip, 1991) for further inductive investigations. To this end, it was decided that an historical analysis of the organisation should be conducted. This involved interviews with employees based in the UK and the reading of company reports. These varied from highly technical documents (e.g. dealing with information system software and hardware) to organisational and political (internal and external) reports on KM initiatives.

3.4.3 Interviews and Informants

In this research, even in a comparatively small organisation like Buckman Labs, the investigator was faced with practical concerns in making decisions regarding the choice and number of informants to be interviewed. Given the practical limitations, the researcher pursued the tactic of "getting a multiplicity of views from various members of the same group" (Bresnen, 1988, p. 47). Hence, informants were selected in order to provide a wide range of different perspectives (Glaser and Strauss, 1967). Another important consideration that arose concerned the social relationships that developed between the researcher and the researched. Like any other communities, the organisational community is a social network characterised by a myriad of psychological, social and political undercurrents (Bresnen, 1988). It is therefore difficult to strike a balance between getting close to the researched and

mentally distancing oneself from the situation under investigation. To achieve this goal, useful methods include a degree of cunning, deviousness, opportunism and persistence on the part of the researcher. In the present case, wearing the hat of an "independent student researcher" helped to resolve and prevent some of the dissonance that might have endangered the data collection process.

Subsequent interviews were conducted on-site at Buckman Labs corporate headquarters in Memphis, Tennessee, USA. The interviews were semi-structured and informants were encouraged to express their experiences in their own words. Interviews were conducted with the most knowledgeable managers and informants. A "funnel sequence" approach was used whereby the interview started with a semi-structured discussion using open-ended questions (Bouchard, 1976). However, in order to provide a managerial as well as an organisational holistic perspective, the researcher formally interviewed 12 top managers (including the Chairman and CEO of the company) and 38 other employees. The range of interviewees adequately covered the different actors and management levels involved in the process. Most of the interviewees were those who had closely observed or had been personally involved in the knowledge-sharing process. The interviews were open-ended and each lasted from one to two hours. The discussions concentrated on the details of knowledge-sharing processes, their technical specifications, each actor's actions and aspirations, and the perceptions of others involved in the same process.

During the interviews, several rules of interviewing and data handling were employed to ensure quality (Yin, 1994). First, the interviews were tape-recorded

with informants' permission. The research followed the general rule of reviewing notes taken during the interviews within 24 hours for any inconsistencies. Secondly, efforts were made to interview as many people as possible to reach the point of theoretical saturation (Glaser and Strauss, 1967).

In addition, as part of this interview strategy, informants were asked a set of structured questions allowing for the elaboration and explanations of issues as they emerged. Following the interview format, rich descriptions of events and procedures that pertained to the research questions were obtained. During the preparation phase, an interview pro-forma was designed as a basis for asking informants similar questions but in a semi-structured way, in line with a conversational interviewing style (Burgess, 1993). The interviews were tailored to each particular group of employees and focused on their perceptions of what happened and why, on how decisions were influenced and made, and how conflicts were resolved. Questions were also asked about the influence of various contextual factors on the process of knowledge-management initiative formation and implementation; the informants' particular role, attitude and motivations; and the outcomes of the previous knowledge initiatives in terms of organisational change and future actions.

Each of the 50 individual interviews lasted about an hour to two hours, with 90 per cent of the interviews being recorded on tape and about 70 per cent being transcribed. Comprehensive interviews were conducted with subjects from five key areas: operations and administration, marketing, research and development (R&D),

the Knowledge Transfer Department, and support departments. Since the research perspective views knowledge sharing as multi-layered, informants from these areas were selected to represent a mix of opinions from employees acting both as managers and users of knowledge. The researcher felt that taking this holistic approach provided rich data and clearly demonstrated the complex nature of KM.

3.4.4 Archival Data

The use of documents alongside observational data enables a comparison to be made between the researcher's observations of events and other informed accounts (May, 1993). The technical details of the KM systems were obtained mainly from such archival data. The documentary evidence permitted cross checking of many of the details presented in the interviews. For example, it was possible to ascertain the reliability of the managers' recollections on technical and other details by comparing them with those reported in the internal documents. A wide variety of internal documents was collected, including Intranet discussions, full project documentation, project planning documents, the minutes of working meetings, inter-office memos, and formal reports dealing with KM processes. In addition, wider organisational material included organisation charts, standard business forms, internal publicity, recruitment handouts, newsletters, company magazines and annual reports.

The use of externally orientated published articles provided yet another way to verify and triangulate the validity of the data collected via interviews. It is worth

noting that several of the participants had also been interviewed for previous studies (APQC, 1996; Buckman, 1998; Ellis, 1998; Graham and Pizzo, 1996). Thus, the present research was able to take advantage of previously acquired knowledge about the general organisational and technological environments of Buckman Labs.

3.4.5 Non-participant Observation

In this study, "the field researcher attempted to become part of the setting being studied, with the goal of describing the setting in as much detail as possible" (Bailey, 1996. p, 3). This aim was achieved by the researcher becoming directly involved with the people being studied and personally experiencing daily life in the setting (Neuman, 1991). Direct observation was used to achieve a better understanding of the dynamic interplay of the strategic elements that played a big role in the implementation of KM.

Two different stages and forms of observations were made. First, during the preparatory phase of the study, the researcher participated in on-line discussions with key decision-makers in Buckman Labs. Through the combination of on-line interviews, in-depth face-to-face interviews and discussions, a rich understanding of the organisation was obtained. Some of the benefits of on-line interviews are as follows. First, they allow informants time to reflect on the incidents being studied, and this in turn provides a more comprehensive picture of the incidents. Interviews are not limited to a specific location or time as questions can be answered virtually anywhere and at any time—for example, some of the informants (the Chairman and

top management) answered questions via e-mail while they were travelling. Secondly, on-line interviews encourage more frequent interactions and thus enhance in-depth exploration of the case being studied. The interviews can be of high quality as informants can choose the best time to answer questions, thereby avoiding the inevitable interruptions that take place during face-to-face interviews (for example, telephone calls and unexpected events). Thirdly, the use of on-line interviews also allows frequent interactions between the informants and the researcher, which helps to generate richer details of the process being studied. In this research, interviews of this type were conducted on average twice a week for three months, which helped to generate a lot of interesting background data and details of the case.

During the data collection phase, on-site observations were made during the six-week fieldwork period. An office was provided in the corporate headquarters with free access to virtually everywhere within the organisation, and the researcher observed and took notes from conversations with employees. A major advantage of this kind of observation is that it permits a here-and-now, in-depth experience (Garvin, 1993; Lincoln and Guba, 1985). Observations of meetings, training classes, and individuals at work were also made throughout the field study. The field notes from these observations were used to verify or elaborate on the interview data. In addition, access to the case company's Intranet was gained: the company supplied a laptop computer, thus allowing observation of knowledge transfer in real time during the site visit. Informal conversations with librarians in the Knowledge Resource Centre gave insights into non-managerial perceptions of

working life within the organisation. Employees who used the corporate library were additional sources of unexpected information for the research. For example, on two occasions managers were doing research about technical information in the KRC, and this allowed the researcher the opportunity to engage in conversations. Other informal observations and meetings with employees in their coffee lounge were also very useful. The researcher found that this type of informal conversation was an important source of information on current issues and attitudes towards organisational KM.

Overall, eight KM-related meetings were attended and observed. Five telephone interviews and over 200 e-mail interviews were used to collect and verify data. A total of over 270 hours of on-site observations (including interview time) were conducted. The following section describes the process by which a detailed chronology was created and applied.

3.5 Phase Three: Data Analysis

Once the data were collected, they had to be analysed. The literature on data analysis presents a diversity of opinions. For example, according to Mintzberg (1979), the process can be compared to the craft of the crime writer. Van Maanen (1988) argues that it is a process of searching for rich and complex descriptions and presenting ideas in a narrative fashion. On the other hand, Strauss (1987) is more explicit about how complex descriptions should be captured. Similarly, Miles and Huberman (1984) are equally concerned with the operational elements of

simplifying complex data through various techniques of data reduction and display. Other suggestions include the creation of flow charts or data displays (Miles and Huberman, 1984) and a reliance on theoretical propositions to develop a case description (Yin, 1994).

To achieve high-quality data analysis, a distinctive framework, based on the focus of the case study, was employed, and this helped to capture relevant details and simultaneously facilitated the complex analysis of the organisational elements inter-linking with the practice of organising knowledge sharing. First, the focus of the case study is on contextual features. It emphasises the emergent, situational and holistic features of knowledge sharing. Accordingly, the research adopts a contextualist approach which involves examining the reciprocal relations between processes and contexts at different levels of analysis (Pettigrew, 1991). Contextualism is adopted in this study as the basis for the research, since the key research aim is quite similar to that stated by Pettigrew (1997) in studying organisational change, but with a knowledge sharing focus. The goal is to trace the dynamic interlinking among organisational elements, the processes of the formation and implementation of knowledge sharing practices, and the different levels of the organisational and wider contexts.

It is worth noting that certain modifications were made to the contextualist approach, as described by Pettigrew, in order to adapt the framework to the knowledge-sharing domain. The research employs a qualitative case study method to investigate the in-depth content, context and processes of knowledge sharing. As

such, the interpretative research does not predefine dependent and independent variables (Myers, 1997), but attempts to focus on the full complexity of human sense making as the situation emerges (Kaplan and Maxwell, 1994). Since the research topic is relatively new and in-depth data was required for a broad range of variables, a case study approach was utilised. The understanding of micro-organisational processes of strategic knowledge sharing requires a method that captures the rich detail of organisational life within a multifaceted context. It provides the opportunity to examine continuous processes within their particular context and to draw on the significance of interconnected levels of analysis.

Secondly, the objectives of the research also present other distinctive demands for the choice of methodology. The exploration of knowledge sharing requires that the chosen methodology is both descriptive and explorative, and also longitudinal. Thus, the methodology must have the ability to depict the KM practices over a period of time and to understand the interactions among the organisational elements. The descriptive requirement suggests the need for the illustration of the origin, continuance and perhaps the end of a phenomenon, while the exploratory requirement implies that each developmental stage of the phenomenon must be linked. The longitudinal requirement is the precondition for such description and exploration. A static snapshot methodology would not have been able to depict the beginning, evolution and the ending of the phenomenon under study.

In order to capture and analyse the complex dynamics of KM within an organisational context, the two-axis framework (contextual and longitudinal) is

further complemented by three stages of analysis (revelation, reflection and literature comparison). Each of these will now be discussed in turn.

3.5.1 The Revelation Stage

Revelation, applied in the present research, presents answers to the questions of "how" and "why" KM initiatives took place. "How" suggests a revaluation of the historical pattern of the KM practice, while "why" means the facilitators and inhibitors of the process. The revaluation stage, in the data analysis process, began after an organisational chronology was prepared.

The complex capturing of social reality in this research is an iterative process involving periods of alternating complexity and simplification. Whilst the complexity period adds in-depth richness to the data, the simplification period is then validated with further data collection throughout the process. One way of reducing complexity is to formulate the primary findings and code key themes by developing a processual analysis or chronology of the organisation.

3.5.1.1 The Creation of an Organisational Chronology

The primary purpose of the initial analysis of archival, observational and interview data was to create an organisational chronology. In particular, the significance of organisational events, personalities and key changes was emphasised. A detailed

chronology of the KM initiatives was drawn up to guide thinking and subsequent analysis. Yin (1989, p. 119) argues that:

> "The arraying of events into a chronology permits the investigator to determine causal events over time, because the basic sequence of a cause and its effect cannot be temporally inverted. However, unlike the more general time-series approaches, the chronology is likely to cover many different types of variables and not be limited to a holistic independent or dependent variable".

With some background information on Buckman Labs' KM system and its practices, two important key initiatives were selected for further in-depth analyses. These two projects were not selected at random but were strategically identified to guarantee exposure to the interactions within the organisation surrounding the practice of KM. As a result, a chronology of the organisation was constructed to show a time frame from 1945 to 1998 (see Figure 3-1).

With the key stages of the KM development identified, further data were collected, reduced, displayed and verified in an on-going iterative process before conclusions were drawn. Data reduction involved simplifying, abstracting, codifying and transforming data that appeared in field notes and interviews.

The qualitative approach facilitated an analysis of different informants' interpretations of organisational KM and their activities around it. In particular, the data were first separated into groups depending on whether they reflected

statements or the actions of management, users and knowledge transfer department members. Then, for each of these groups, interview transcripts and field notes were examined to identify statements or actions that reflected assumptions, knowledge or expectations of KM and its implications for work and the organisation's operations as a whole.

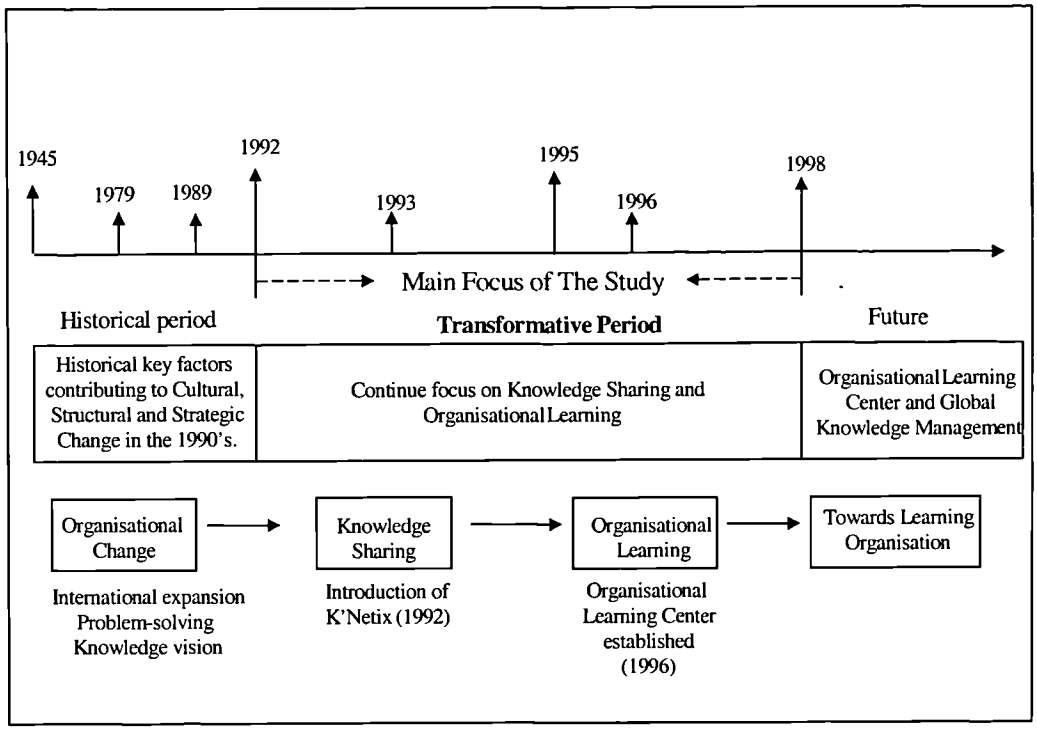

Figure 3-1: An Organisational Chronology of Buckman Labs' Global Knowledge Management

3.5.1.2 The Codification Process

Subsequently, the data were coded according to the method suggested by Strauss and Corbin (1990), who identify three types of coding: open, axial and selective. These are analytic types and they do not necessarily have to follow on from each

other. Open coding refers to that part of the analysis that deals with the labelling and categorising of phenomena as indicated by the data. The products of labelling and categorising are concepts, the basic building blocks in grounded theory construction (Pandit, 1996).

Data were initially broken down by asking simple questions focusing on what, where, how, when, how much, *etc.* Some of the emerging themes in the process included the use of IT, leadership, cultural change, the formation of communities of practice, and KM-focused HRM. Axial coding and open coding are also part of the coding process. The researcher considers the categories of open coding, identifies one as a central phenomenon, and then returns to the database to identify (a) what caused this phenomenon to occur, (b) what strategies or actions actors employed in response to it, (c) what context (specific) and intervening conditions (broad context) influenced the strategies, and (d) what consequences resulted from these strategies (Creswell, 1998, p. 239). The overall process is one of relating categories of information to the central phenomenon category (Strauss and Corbin, 1990). Finally, according to Creswell (1998), selective coding is the final phase of coding the information. At this stage, the researcher takes the central phenomenon and systematically relates it to other categories, validating those relationships and filling in categories that need further refinement and development (Strauss and Corbin, 1990).

During the coding process, interview transcripts were analysed through the categorisation of emergent concepts and ideas (Miles and Huberman, 1984) and the

constant comparison of these concepts (Glaser and Strauss, 1967) in order to identify common themes. Interview notes were organised across informants according to key components of the interview protocol (where components were based on socio-technical constituencies). The content of all the interview transcripts, observation notes and documentation was read in order to identify key issues and themes. A brief interview note form (Miles and Huberman, 1984) was prepared after each interview to highlight emergent themes, variables and other issues of interest which would be followed up in subsequent interviews. These preliminary themes and topics were then analysed and aggregated to arrive at a set of topics that were commonly recurring. A number of themes were thus ruled out in the early stages of data collection, when interviews revealed them to be of little theoretical significance. All the data were then re-studied and re-categorised in terms of the new set of common themes. Such an iterative analysis of data and themes, as suggested by Orlikowski (1996), allows the emergence of a conceptual framework that reflects the grounded experiences and interpretations of the actors in their contexts, while also providing an analytic framework for other contexts.

3.5.2 The Reflection Stage

After the initial data were collected, coded and analysed, the researcher began to reflect systematically on the existing experience and knowledge related to the phenomenon under examination and adapted them (the data) to the research questions being investigated. One powerful tool employed by the research during the reflection process was the continuous writing of short essays about each of the

themes identified in the revelation process. In fact, the research writing output at various junctures in the research assisted the inductive process of pattern recognition and theory building.

3.5.2.1 Writing Essays

The researcher began writing about the case at this stage in an attempt to identify emerging themes: several drafts of the case study were written in order to clarify thinking about the analysis and the quality of the data collected. As time passed by, the written accounts moved from an historical focus on the initial themes of KM to an analysis of the processes of managing knowledge, with an equal emphasis on information technology, KM-focused HRM and knowledge-enterprising communities of practice. This writing process served as a self-learning and sense-making mechanism.

3.5.2.2 The Triangulation Process

Once essays were written, the quality of analysis was further improved through the application of the triangulation method. Stake (1995) defines triangulation as the protocols that are used to ensure accuracy and alternative explanations. Triangulation in research terms usually means that researchers use different sets of data, different types of analyses, different researchers, and/or different theoretical perspectives to study one particular phenomenon (Denzin, 1978). These different points of view are then studied so as to situate the phenomenon and locate it for the

researcher. The need for triangulation arises from the ethical need to confirm the validity of the processes. In case studies, this can be done by using multiple sources of data (Yin, 1984). Snow and Anderson (1991) assert that triangulation can occur in relation to data, investigators, theories and even methodologies.

Triangulation methodology (Denzin, 1978; Jick, 1979) is used to gather different types of data that can be used to cross check for reliability. As Jick (1979, p. 609) puts it, triangulation may also help to uncover the deviant or off-quadrant dimension of a phenomenon. Thus it may synthesise existing theories and help the researcher to create new ones. The aim is to draw on the particular and different strengths of various data collection methods. Interview data were triangulated during both phases through a qualitative content analysis of corporate public documents such as annual reports, company newsletters, newspaper reports, and external journal articles for the period 1992-1998. This step aided understanding, helped to form a clearer picture of the process, and also helped in checking for possible memory failure and ex-post rationalisation by managers (Huber and Power, 1985).

3.5.2.3 Member Checks

In addition to creating a chronology and engaging in early writings, member checks were considered important and applied at this stage. Member checks in this case means that some of the written works and initial analysis of the case materials were checked by people related to the organisation. As archival data were collected in the

form of newsletters, handbooks, vignettes and instructional videos produced by Buckman Labs or copied from the company's Intranet, they were used to triangulate the information gathered from the informants and to validate the interpretations of the interview notes. Additionally, key informants were given copies of the first order and second order analysis (discussed in more detail below) and were asked to provide corrections of facts and to note questions of interpretation. These comments were incorporated into the revisions of the final analysis. Additionally, the interpretation of the empirical events was furthered through discussions with other members of the research group and several KM researchers and practitioners outside the case company.

3.5.3 The Literature Comparison Stage

After the initial analysis was triangulated and checked by members of the case organisation, the next stage was to compare the findings with the existing literature to reveal and explain similarities and differences. As Eisenhardt (1989, p. 545) states:

> "Overall, tying the emergent theory to existing literature enhances the internal validity, generalisability, and theoretical level of the theory building from case study research...because the findings often rest on a very limited number of cases."

The key in this stage is to consider a broad range of literature in context. Examining a range of contrasting literature is important for two reasons, according to

Eisenhardt (1989). First, it helps to improve the confidence levels (internal validity and generalisability) of the research findings. Secondly, it presents analytical opportunities for the researcher. In this comparison phase, literature which discusses similar findings is also important because it ties together underlying similarities in phenomena, thereby resulting in a theory with stronger internal validity, wider generalisability, and a higher conceptual level. For example, Burgelman (1983) strengthened the theoretical scope and validity of his research by linking his work to existing literature, resulting in a higher conceptual level of his findings and enhanced confidence in their validity.

In the present study, findings from the data were compared with the existing literature to consider their similarities and differences. In order to strengthen the theoretical scope and validity of the study, the findings relating to the organisation of knowledge-sharing practices were linked to the literature on the social construction of technology, communities of practice and other existing KM studies.

3.6 Reflections on the Journey: Methodological Problems Encountered in the Study

Throughout this study, the researcher was confronted with a number of methodological challenges and difficulties. These were mainly caused by the complex multi-disciplinary nature of the study. First, the researcher had to choose whether to undertake a broad literature review covering a number of social, technical, cognitive, managerial, economic and organisational issues in organising

knowledge sharing or to opt for a much narrower but deeper analysis of a limited number of existing KM studies. By adopting a holistic or pluralistic perspective (Spender, 1996), the first alternative was preferred, and a review was then conducted in the belief that such an analysis of the literature could provide a broader foundation for this exploratory study. Such a review strategy had clear implications for the ways in which the empirical data were to be collected, analysed and presented. For example, a broad review of the literature implies that the analysis provided by this study is also much broader than in most other studies of this kind. Inevitably, the review has provided a wider platform for discussions of this multi-faceted, multi-layered and context-dependent study, and has also limited the depth of the analysis that this study could provide.

Secondly, there was also a challenge in deciding which specific aspects of KM to study. As already explained, a number of different knowledge-related activities can be observed in most organisations, for example knowledge creation (Nonaka and Tackeuchi, 1995), knowledge transfer (von Krogh and Roos, 1995), knowledge integration (Grant, 1996), knowledge appropriation (Orlikowski, 1992), knowledge search (Hansen, 1999), knowledge access (Nahapiet and Ghoshal, 1998), knowledge assimilation (Balasubramanian, 1995) and knowledge retention (Scarbrough *et al*, 1999). In the case of this study, the challenge of choosing which aspects to study resulted from the difficulties involved in clearly separating different activities. Rather than undertaking such a pointless task, the researcher chose to concentrate on the interplay and interdependence of socio-technical factors in organising knowledge sharing within Buckman Labs. This gave the researcher

more room to explore the dynamic complexities of a KM issue, rather than focusing on something narrow and static, as in many previous studies.

Thirdly, there is the question of whether KM researchers should possess intensive knowledge of the particular industry/business context being investigated. As far as this researcher is concerned, his lack of a specialised knowledge of chemistry is not a problem as the focus of the research is on the organisational processes of knowledge sharing rather than an understanding of the knowledge being shared. This particular concern could be of interest to future KM studies, in terms of whether the researcher requires in-depth knowledge of the subject or organisations under-studied.

Fourthly, the researcher was also concerned with the validity of the data collected, i.e. whether or not the data expressed the considered and authentic views of the informants, with minimum interference or distortion by the research process. As this research was partly based on archival and oral history evidence, despite the difficulties involved in this kind of retrospective interpretation (cf. e.g. Barley, 1990, p. 228), the documentary evidence permitted the cross-checking of many of the details presented in the interviews. It was possible to control the reliability of the managers' recollections on technical and other details by comparing them with the contents of the documents. The interpretation of the empirical events was further validated through discussions with the other members of the research group and several well-informed knowledge-management practitioners outside the case

study. Also, a case study was presented to the main informants as part of the first-order analysis to check for any factual or interpretative errors.

Fifthly, during the data collection and data analysis process, two types of potential bias were prevented: the effects of the researcher on events and the behaviour of participants at the case study site; and the researcher's own beliefs, values and prior assumptions, which may have prevented adequate investigation and consideration of possible contradictory data and unduly influenced the analysis of the case study evidence (Darke *et al*; 1998). To avoid such bias, the following steps were taken: (1) the informants were given the opportunity to ask questions regarding the purpose of the study and were assured that their individual comments would remain confidential. (2) They were also informed that they could refuse to answer any questions during the interview. The interviews were recorded only with the express permission of the informant; and informants were also allowed to stop the recording at any time during the interview. (3) The researcher agreed that existing notes and cassette recordings of all the interviews were to be destroyed after the study was completed.

One of the distinctive features of the data collection process in this research was its ethnographic character: the researcher collected data as a "non-participant observer". In fact, acting as an instrument of data collection (Brown, 1984), case researchers can play various research roles: for example, those of teacher, advocate, evaluator, biographer and interpreter (Stake, 1995). In this study, the researcher consciously or unconsciously made continuous decisions about how much

emphasis to give to each role over time. For example, at one stage, the researcher acted mainly as an advocate of KM. This is because the background and the intentions of the researcher were made known and distributed around the company via its Intranet from the beginning of the fieldwork period, and as a result some informants labelled the researcher "proactive". Efforts were made by the researcher to encourage his informants to disagree with the findings presented to them. In other situations, the researcher was regarded as the evaluator of the current KM practices. In one incident, an informant asked if the researcher was an external representative of the quality circle which sought to evaluate employees' performance on KM, and was expected to make appropriate suggestions to the top management based on the findings.

The role of the case researcher could also be described as that of a biographer. In social science, biographies are often "life histories" of what is explored against a thematic social network. During the process of negotiation for access in this research, the proposal for presenting the outcome of the study as a biography of the company's KM efforts was regarded by the Chairman as a distinctive strength. During part of the time spent in the field by the researcher, serious attempts were made to recognise and understand how KM took place over time. On the other hand, as the approach taken for this research was considered as an iterative process, the researcher acted as an interpreter throughout the data collection period. The researcher was considered by some of the informants as the agent of new knowledge and interpretation. Hence, the researcher tried to recognise and substantiate new meanings.

An important question to ask at the end of this discussion of methodology is the extent to which the methods employed in the case study enabled research findings to be generalised to other organisations. Unlike the situation in a quantitative case study, the generalisability of a qualitative study is not determined by random sampling and statistical inference but is derived by gaining an in-depth understanding of the patterns of behaviour and interactions of organisational elements within a specific context. Therefore, the generalisability of the case study is limited. The aim of this research is to use thick description to boost the generalisability of a qualitative study by revealing the social relations that underpin the process in question. In other words, this study attempts to conceptualise a phenomenon in terms of its conditions of existence and the social relations that characterise it rather than the simple description of immediate appearances.

3.7 Conclusion

This chapter has discussed some of the key philosophical issues underlying methods in the social sciences, and has studied the implications of these issues for the design of KM research. The aim of this qualitative case study is not to produce a representative and unbiased measurement of the views of a population, but to deepen our understanding of a social phenomenon by conducting an in-depth and sensitive analysis of the articulated consciousness of actors involved in the phenomenon. The study argues that, since issues of KM can only be interpreted by developing a deep understanding of the social context, the researcher needs to obtain first-hand information by 'getting inside' and 'being one of them'. The

research involves both an historical reconstruction of the period 1992-1997 and a longitudinal study of what events and processes took place in 1998. There are, of course, valid concerns about comparing two periods, one based on historical reconstruction by participants, and the other based on the period studied in real time.

Thus, the research was exploratory in nature. The decision to use the case study method was made because the aim of the research was to examine how knowledge sharing was organised over time. In other words, the purpose of this study was to obtain a sufficient depth, rather than breadth, of understanding of the organisation of knowledge sharing. As a result, a qualitative approach was used to analyse the data (Pettigrew, 1997; Strauss and Corbin, 1990). Case study, according to Benbasat *et al.*(1987), was primarily used for an exploratory purpose. In particular, case studies are seen to be more appropriate than surveys in answering the "how" and "why" questions (Yin, 1989). Since the primary concern of this research was to understand the underlying processes, mechanisms and the related patterns of behaviour leading to the development and implementation of KM, an ideographic methodological approach was used. No hypothesis and standardised data collection techniques were developed or employed. After identifying the concerns of KM and conducting a detailed literature review, a research argument was established. An in-depth case study was then conducted in a distinctive knowledge-intensive company.

During the research, the researcher was constantly faced with two key problems that have, ironically, helped to determine and shape the boundaries of the research:

the problems of multiple disciplines and practical access. This combination of concerns suggests that some of the traditional assumptions and practices in social science research may very well need reconsideration for the purpose of KM research. Thus, one of the aims of this chapter is to help shed some light on the process of developing a distinctive methodology for the investigation of KM issues.

The methodological approach adopted here means that the research strategy did not follow a logical sequence from research question to data collection, analysis and output, characterised by positive methods. A more iterative and reflexive series of learning activities was undertaken as the researcher adopted a flexible approach to the data and became attuned to the possibility of further revision of the work. The present study uses interpretivism as its epistemology. This is based on the views that people socially and symbolically construct and sustain their own organisational realities (Berger and Luckmann, 1966; Morgan and Smircich, 1980). Accordingly, knowledge itself, in this research, is seen as socially constructed. Thus, with the aim of building a theory of KM, the interpretative approach requires a methodology that is concerned with generating descriptions, insights and explanations of events so that the system of interpretations and meaning, and the structuring and organising processes are revealed (Gioia and Pitre, 1990).

The main contribution of this chapter is to present and justify an interpretative approach as a means of inquiry. The research methodology has been derived on the basis of the sociological and philosophical beliefs of the researcher. This chapter stresses that theory building in the area of KM can be accomplished through

empirical investigation, as to be presented in Chapter 4. The following descriptive analysis in chapter 5 is focused on the development of KM in an organisation that has provided intra-organisational global knowledge sharing for its employees since 1992. The study describes the characteristics and dimensions of this distinctive initiative as one particular form of organisational KM that has the potential to improve the performance of the firm. At the same time, the research provides theoretical reasons why the KM described in this case might work effectively and suggests that it should be regarded as a fascinating revelatory case (Yin, 1994) of a pioneering organisation with a distinctive global KM system.

4 Chapter Four : Organising Knowledge Sharing at Buckman Laboratories

4.1 Introduction

Based on a grounded theory framework, an iterative case study method was used to collect, arrange and analyse the research data. The presentation of data uses a processual approach. The aim is to describe a knowledge-intensive organisation by concentrating on the issues that have the most significant implications for organising knowledge sharing, especially in terms of the relationship between technological, social and managerial factors. The resulting analysis provides insights into the organisation of knowledge sharing. In particular, it highlights the interplay between ICTs and organisation by means of a socio-technical analysis which encompasses the relations, tensions and resources associated with the use of an ICT-based KMS, the facilitation of a knowledge-sharing context, and the development of a KM-focused HRM.

This chapter discusses the interplay between the social and technological factors that influence the knowledge-sharing process. These factors are examined at a broad contextual, processual and organisational level. In adopting a holistic view on organising knowledge sharing, the chapter is structured in a way which the boundaries of relevance maybe harder to define. For example, as mentioned in the

methodology chapter, the investigator was faced with theoretical and practical concerns in making decisions regarding the choice and number of socio-technical issues involved in organisating knowledge sharing. Having taken a holistic view of knowledge sharing, the researcher pursued the tactic of getting an overall picture instead of going for an in-depth analysis of only a small number of issues. This, perhaps, can be seen as a problem and limitation for any study with a socio-technical focus, such as the present study.

Specifically, the following sections introduce the knowledge-management journey taken by Buckman Labs from 1945 to 1998, with an interpretative view of that journey and the main knowledge-sharing initiatives. A general description of the knowledge-sharing process and important issues related to organisational changes are also outlined. Section 4.2 describes the nature and orientation of the specialty chemical industry and emphasises the growing importance of KM in global business. Section 4.3 describes the organisational background of Buckman Labs. Section 4.4 provides a brief account of Buckman Labs' history (1945-1991). Section 4.5 focuses on the motivation for organising global knowledge sharing at Buckman Lab. Section 4.6 concentrates on the integrative aspects of the technical issues of knowledge sharing. Section 4.7 describes the interactive aspects of the socio-technical interrelationships of organising knowledge sharing. Section 4.8 highlights the key issues to emerge from the case study. Section 4.9 brings together some concluding remarks.

4.2 The Background of the Specialty Chemical Industry

There are no perfect examples or templates to explain the activities, processes and mechanisms that are embedded in the organisation of knowledge sharing. In order to penetrate the mist surrounding the over-theorised concept of KM, this study closely examines a knowledge-intensive organisation with institutionalised KM activities in the specialty chemical industry, tracing the evolution of its organisation of knowledge sharing from 1992 to 1998.

The specialty chemical industry is characterised by more stable demand, higher values of products, more restricted competition, lower financial commitment to plant capacity, lower output volumes, and a higher technological content than is normally the case with commodity chemicals. A combination of all these factors tends to delay, if not permanently discourage potential new entrants from developing countries from entering their chosen markets in any strength.

The products of the specialty chemical industry are of fundamental importance to all manufacturing industries as they contribute essential base materials. As a marketing manager explained:

> "The development of specialty chemicals for commercial use is highly specialised, and many refinements and modifications are necessary to make them suitable for use in particular applications. Moreover, uncertain levels of demand, the need

> for continuously high output and frequently weak prices for bulk chemicals over many years have convinced the chemical companies to concentrate their resources on the manufacture of speciality chemicals, which involves a higher technical content and greater added value."

Competition in the industry is also intense because of the large number of manufacturers who inevitably overlap in many of the markets for their products. On the other hand, throughout the industry, expenditure on research and development (R&D) as a percentage of turnover is increasing. This is because success depends mainly on the development and conversion of high-quality R&D projects into a stream of new products. Markets for specialty chemicals are now global, and companies perceive that there is a need to expand into new and unfamiliar areas in order to ensure their future growth.

More and more companies are recruiting highly educated employees to deal with the diversity of tasks within the industry. For most R&D positions, PhDs are an essential requirement, and sales people are also expected to have university degrees so that they are able to handle a wide range of technical questions. At the same time, fewer companies are employing large workforces at individual manufacturing sites, even though the trend is towards concentration of production. Operational flexibility is very important, and this can usually be better achieved in smaller manufacturing units. In the late 1980s, many speciality chemical companies undertook major strategic reviews in response to the increasing global

competitiveness of the industry, cyclical business trends, and the need for regular large capital investments.

To sum up, it can be said that the industry context is global and knowledge-intensive. It is also characterised by a high rate of process and product innovation, and the need for a high degree of product customisation for individual customers. Therefore, to compete successfully, a specialty chemical organisation must have knowledge capabilities that, at the very least, enable:

- the maintenance/enhancement of technological excellence: i.e. employees must keep up with the up-dated knowledge of internal and external technological innovations; and
- the appropriate delivery of customer solutions based on learning from experience (embracing products, process and market characteristics).

4.3 The Organisational Background of Buckman Labs

Buckman Labs is a privately-owned specialty chemical company based in Memphis, Tennessee in the USA, with a 50-year history of developing, manufacturing and marketing proprietary chemical products. It has operations in 21 different countries, with 18 principal Buckman Labs companies (branches) outside the USA selling 1,000 different specialty chemicals (see Table 4-1). Nineteen of these companies are engaged in 80 countries, marketing and selling the chemicals that are manufactured at eight strategically placed locations. The twentieth

company, Buckman Laboratories International Inc., provides the support functions (R&D, Legal, Marketing, Knowledge Transfer, etc.) to these profit centres across the world. Altogether, these Buckman companies employ 1,300 people with annual sales approaching US$ 300 million.

North America	• Buckman Laboratories of Canada, Vaudreuil, Canada
Latin America	• Laboratorios Buckman S.A, Buenos Aires, Argentina • Buckman Laboratorios Ltds., Campinas, Brazil • Buckman Laboratories, S.A. de C.V., Ciernavaca, Mexico
Africa	• Buckman Laboratories (Pty.) Ltd., Hammarsdale, South Africa
Europe	• Buckman Laboratories, S.A., Ghent, Belgium • Buckman Laboratories Gesellschaft, Manchester, England • Buckman Laboratories Gmbh, Bad Homburg v.d.H., Germany • Buckman Laboratories Italiana, S.r.l., Milano, Italy • Buckman Laboratories S.A.M., Monaco • Buckman Laboratories Quimica (Portugal), Lda., Parede, Portugal • Buckman Laboratories Iberica, S. A., Barcelona, Spain • Buckman Laboratories AB, Stockholm, Sweden
Pacific Rim	• Buckman Laboratories Pty. Ltd., Wagga Wagga, Australia • Buckman Laboratories New Zealand Limited, Auckland, New Zealand • Buckman Laboratories (Asia) Pte Ltd., Singapore • Buckman Laboratories K.K., Tokyo, Japan

Table 4-1: Buckman Labs' Branch Companies World-wide (Buckman Internal Document, 1998)

Buckman Labs works with manufacturing industries to provide advanced chemical treatment technologies and extensive technical services to solve complex industrial problems. The company's expertise spans a broad range of specialty chemicals including microbicides, scale inhibitors, corrosion inhibitors, polymers, dispersants and defoamers. In terms of size, Buckman Labs is smaller than its major competitors, so in order to achieve its corporate goals, it has to use its resources more intelligently. Under increasing pressure from growing competition and the

globalisation of the industry in the late 1980s, some key strategic decisions were made to focus the company's limited resources on the most important area of cash generation -- the interface with customers. More specifically, one of the main business strategies was to concentrate on those market areas in which Buckman Labs had developed a particular expertise. As VP-HRM pointed out:

> "We decided in the 1980s that we would only concentrate on the a handful of industries that we have particular expertise. The goal was thus to benefit directly by connecting all employees world-wide, harnessing their collective explicit and tacit knowledge, and focusing on improving the performance of the company's customers."

Buckman Labs competes in a variety of businesses, from pulp and paper processing and water treatment, which make up 60 per cent of sales, to leather and agriculture. Other key industries include industrial water-treatment, agriculture, wood treatment, and formulator markets. The total number of employees at Buckman Labs in its Tennessee headquarters is now about 400, including sales, research and design (R&D), manufacturing, technical and support personnel (Buckman Internal Document, 1998).

Since the late 1980s, the specialty chemicals industry has had to consolidate as customers have reduced their list of suppliers to just a few. At the same time, competition has shifted from being sales-based to being focused on problem solving. As a result, Buckman employees must not only possess knowledge of

products and their underlying chemistry, but also possess the 'know-how' relating to product application. In other words, the expectation of knowledge in Buckman Labs is high in terms of both explicit knowledge (product knowledge) and tacit knowledge (industry changes, product applications and problem solving). Under the pressure of fierce competition in the late 1980s, the company's commitment to knowledge took on a new urgency. In particular, the increasing proliferation of specialised and distinct knowledge communities and the need for their integration resulted in the push for enhanced knowledge sharing at Buckman Labs.

In order to apply a socio-technical perspective to explore this development, the research findings are grouped in four categories relating to knowledge infrastructure, including knowledge architecture and organisational knowledge memory; technological infrastructure and processes; the nature and scope of change activities; and the human resource aspects of knowledge-sharing activities.

4.4 A Brief History of Buckman Labs (1945-1991)

Even before the implementation of institutionalised knowledge sharing practice in 1992, Buckman Labs' overall business strategy was basically geared towards a commitment to problem-solving and customer satisfaction. Knowledge of a customer's production processes and objectives, together with knowledge of chemistry and microbiology and the creativity to bring these together, became job requirements for most Buckman employees. This, together with a service-oriented

approach, helped the company's customers to increase productivity, quality and profitability for more than 50 years.

Buckman Labs' origins date back to 1945, when Dr. Stanley Buckman (founder of the company) saw an opportunity to commercialise an idea for paper manufacturing (Buckman Internal Document, 1997). Stanley Buckman was a microbiologist and biochemist with a background in forestry and a familiarity with the pulp and paper industry. As a result, he was particularly interested in the industry's production problems. In 1945, he created Buckman Labs' first product, the BSM-11, which became the forerunner of a range of products that launched the young company on its way.

The 1960s saw international expansion and the addition of important new industrial markets for Buckman Labs. New manufacturing and sales companies were established in Mexico and Belgium (then serving as the European headquarters). This expansion continued into the 1970s. As the HR Vice President explained in 1998:

> "At the same time new products were brought to market. The sales force and the manufacturing facilities continued to expand with the company becoming increasingly recognised as a leader in microbiological control in a number of countries."

At the end of the 1970s, Bob Buckman (son of Stanley Buckman) took over and began to reorganise the hierarchical structure of the company. At that time, Buckman Labs was a company with sales of $29 million employing 493 people (39% were college graduates).

As Buckman Labs entered the 1980s, it was a very top-down organisation with centralised decision-making. This system was not consistent with the distributed environment in which the organisation was operating. Even though the slogan 'Creativity for Our Customers' was adopted by the organisation in the 1960s, Buckman management was convinced that the company was too product driven. They realised that the organisation could no longer compete successfully using a product-driven strategy. As a result, they realigned the decision-making process and attempted to revamp the whole organisational culture. In 1982, Buckman Labs made important changes and became customer-driven, necessitating a corresponding change in the organisation. In particular:

> "with operations in seven countries, management had to begin to recruit and train a much larger sales-force which grew at a rate of 20 per cent for some years. Sales increased at a percentage rate that was equal to or greater than the percentage of the sales force increase." (VP-HR 1998)

With global expansion, it became obvious to the management that they had to speed up the knowledge-sharing process in order to be effective and efficient.

However, the scale and direction of the necessary change was vast and difficult, since, for much of its history from 1945 to the 1980s, the company had had a product orientation. Previously, as its main business strategy, it had always tried to look for new chemicals with a corresponding emphasis on research and development. The managerial philosophy was one of command and control within the corporate hierarchy.

This can be illustrated by the example of the flow of information and knowledge. Before 1992, all requests for information were channelled through the Technical Information Centre (TIC) at corporate headquarters. Members of the TIC were responsible for making sure that requests received attention and that experts were located in the field to address problems. Solutions or suggestions were usually transferred by fax or by post, but this method proved limited, inefficient and ineffective. For example, in December 1991 a Brazilian employee requested expert information about a particular chemical, and it was six weeks before a response was received by post. Using Buckman Labs' KMS, this would now take only a few hours or days.

4.5 The Motivation for Organising Global Knowledge Sharing

Three critical factors contributed to Buckman Labs' determination to become a knowledge-intensive organisation. First, the global expansion of Buckman Labs from a small local business in the southeastern United States to an international

corporation with operations in a number of countries played a major role. With the continuous expansion of overseas subsidiaries, a more efficient and effective method of knowledge sharing became increasingly necessary. Secondly, there was a strong commitment to problem-solving for customers, reflected in the increasing reliance of the company on personnel who were well educated in chemistry, biology or engineering and who received continuous in-house training. This commitment to problem solving also led to the need to establish a broader knowledge transfer capability in the 1990s. Thirdly, Buckman Labs' determination to eliminate the company's command-and-control structure also triggered its decision to compete by using the collective knowledge of its employees.

In the late 1980s, the company's vision (the need for global knowledge sharing) evolved into an attempt to establish an e-mail system based on an internal modem bank for the sharing of best practices around the world. By 1987, Buckman Labs had linked up with IBM's global computer network. Its first formal and organised system to share and capture knowledge within its subsidiaries dates back to 1988, when the company's Case History System was initiated. As a forum specialist explained:

> "A case history is an electronic copy recording how a front-line sales associate creates new knowledge within the organisation. It is achieved by solving customers' problem either by applying existing "Buckman knowledge" (if it was a well-documented problem) or by

> developing a new, more effective solution (if it was a new problem). This repository, with full text search capabilities, was accessible to all employees worldwide through PCs connected to a telephone line. In total, Buckman Labs had 2,472 case histories, 1,787 in English and the remainder in Spanish."

However, as the demand for an enhanced technological capability grew (with the need for more mobility within the system), it was soon apparent that the mainframe-based approach was not workable in the long term. Therefore, in order to become competitive in its increasingly knowledge-driven industry, in the late 1980s Buckman management decided that they must improve the efficiency of organising knowledge sharing globally, and this required a new business philosophy. According to an an informant (adminsitrative), the central tenet of this new philosophy is as follows:

> "to be a player in today's global market an organisation must have easier access to the available information than ever before. In order to make sound strategic decisions, a company needs relevant up-to-date information on world-wide competitors, customers, joint ventures, trading opportunities and economic developments." (Internal Document, 1997)

By 1989 Bob Buckman, the Chairman, personally pledged that knowledge would become the foundation of his company's competitive edge. Three years later, the implementation of the K'Netix® knowledge network marked the beginning of the

realisation of Buckman Labs' vision. The K'Netix® was founded on several key principles (Zack, 1999: 53):

- Direct exchange of knowledge among employees
- Universal, unconstrained ability to contribute to and gain access to firm's knowledge without regard for time zone, physical location, language, or level of computer proficiency
- Preservation of conversations, interactions, contributions, and exchanges
- Easy accessibility – that is, searchable by all Buckman Labs employees

In particular, at the core of the network was a simple premise:

> "By connecting people through a network, you replace the depth of knowledge offered in a multi-tiered hierarchy with the breadth of knowledge that is the sum of the collective experience of employees." (Bob Buckman, 1998)

A global knowledge network, K'Netix®, was then introduced to provide for the interactive sharing of tacit knowledge and the storing of explicit knowledge on a worldwide basis. K'Netix® had three basic features that can be accessed on laptop computers: e-mail, personal home pages for each employee, and several regional and functional forums and databases.

4.6 The Integrative Aspects: The Technological Components of Organising Knowledge Sharing

4.6.1 The Development of Knowledge Architecture in 1992

Buckman Labs started its search for a system that could support the sharing of both explicit and tacit knowledge in the early 1990s. With the Chairman's pioneering vision in mind, the Vice President of the KTD set out to build a single knowledge network encompassing all of the company's knowledge and experience, and allowed Buckman representatives to focus the company's capabilities on customer challenges. As explained by one informant:

> "Within a couple of months, CompuServe was chosen as the e-mail and forum provider as well as the network provider, largely due to its emphasis on the individual, dial-connected user. While this technology was not new, its use as a global business communication platform was a radical departure from the traditional IT solution for these services, especially in Buckman Labs. Buckman users around the world could use e-mail and forums to share knowledge via messages on the forums, company-wide discussions and documents authored using PC tools."

In March 1992, Buckman Labs set up a Knowledge Transfer Department (KTD, see Figure 4.1) and appointed a Vice President who had a PhD in organic chemistry, possessed strong computer skills and had spent the previous year

studying the theoretical possibilities of global KMS. Furthermore, an R&D technical information centre (TIC), which had formerly served as a clearinghouse for technical questions from world-wide offices, was renamed the Knowledge Information Centre (KIC) and then the Knowledge Resource Centre (KRC) as part of the KTD. The KTD was responsible for the design and on-going management of knowledge sharing. At the time of data collection in 1998, 90 per cent of the 50 KTD employees were responsible for the design, development, implementation and maintenance of the software and hardware of the ICT-based KMS. The other five employees were located in the KRC, and their responsibilities included the monitoring and processing of the knowledge generated within the various sections of Buckman forums, with particular reference to social and organisational, rather than technical, perspectives.

By the end of 1993, for a total cost of US$75,000 per month, all Buckman employees could make a single phone call using a ThinkPad 720 with a modem to establish point-to-point communication with headquarters and gain access to the global KMS. Based on this concept, K'Netix® was introduced with seven forums (three customer-focused forums and four regional-focused forums) to co-ordinate Buckman Labs' on-line conversations and exchanges of information and knowledge.

> "By the end of 1992, Buckman Labs had invested US$8 million in laying the groundwork for its new KMS. By

> March 1993, every employee was able to access the K'Netix®, enabling Buckman employees to share knowledge and setting in motion the delivery of enhanced services to customers". (Journal of Business Strategy - Buckman 1998, p. 23)

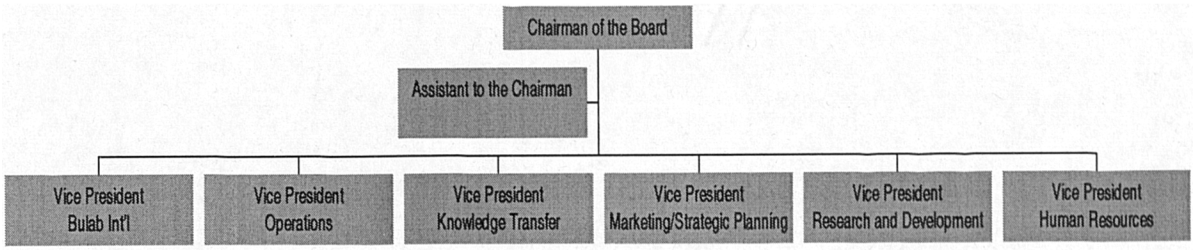

Figure 4-1: Organisational structure of Buckman Laboratories (Source: Buckman Labs, 1998)

According to one informant, the development of the ICT-based KMS was based on Buckman Labs' business needs and practices. It evolved over a period of time and has become an integral part of Buckman Labs' knowledge sharing culture. The adoption of the K'Netix® system also reflected the explosive growth of the company, and the adoption of Internet and Intranet technologies provided an enormous catalyst for the knowledge that Buckman Labs needed. For example, the ability to sell new products has always been a key performance indicator for Buckman Labs, as recorded in an internal document:

> "the company's successful efforts in organising knowledge sharing have been credited for the company's 250% growth in sales in the past decade. In the four years prior to the adoption of K'Netix®, 14 per cent of

> Buckman's sales were based on new products. In the four years after its introduction, the figure rose to 34.6 per cent (1996). This dramatic improvement reflected the company's enhanced ability to develop new products more rapidly to meet the changing needs of their customers." (Buckman internal document, 1997).

Combining 'Buckman knowledge' with electronic forums, bulletin boards, virtual conference-rooms, libraries and E-mail, K'Netix® also gave Buckman employees unlimited access to expertise, experience and resources in more than 90 countries. K'Netix® is divided into two basic categories: organisational forums and codified databases. All 1,300 of the organisation's employees world-wide have CompuServe identification and passwords (though only about 1,000 had their own laptops or personal computers), and they use the network for both intra- and inter-company communications.

K'Netix® was the knowledge architecture of Buckman Labs. It put the most knowledgeable experts in the organisation in touch with each other, thus encouraging group problem solving and the sharing of new ideas and knowledge. In fact, Buckman Labs trademarked the name K'Netix® to convey not only the power of the KMS but also the broader benefits of a knowledge-sharing corporate philosophy. The result is that Buckman Labs has successfully combined the integrative and interactive aspects of organisation and knowledge flow (Zack, 1999).

As a socio-technical study of organising knowledge sharing, the focus of the present research is not on the capability of the technology; rather, it aims to understand the interactions between users and the adopted technology. However, before examples and problems of actual knowledge sharing process are presented, the following section examines the integrative aspect of knowledge architecture at Buckman Labs, that is, the nature and technological features of the ICT-based KMS in its development and implementation stages.

4.6.2 The Establishment of On-line Regional Forums: 1992-1997

Technically speaking, the on-line community at Buckman Labs was regionally and functionally structured and developed between 1992 and 1997. There were four different regional forums available on-line: the TechForum, Euroforum, LatinoForum, and AAAForum. These forums (see Table 4-2), only accessible to company employees, are each further divided into sections based on Buckman Labs' lines of business, e.g. water treatment and leather. Codified databases come from a number of sources: valuable knowledge that can be generated from discussions on the forums, and uploaded external secondary material and any materials that are helpful to Buckman employees (e.g. competitive intelligence).

Date of Inception	*Name of Regional Forum*	*Language*
September 1992	TechForum	English
September 1994	Foro Latino	Spanish
March 1997	EuroForum	European Languages (French, German and others)
August 1997	AAA Forum	English

Table 4-2: Regional Forums: Names, Dates of Inception, Memberships and Language Use (Source: Buckman Labs' internal document 1998)

These four regional forums constituted the central pivot of Buckman Labs' knowledge sharing and are accessible by all employees. According to an internal document (1996):

> "one of the analogies used to describe the function of the network structure is to think of a forum as a town where the inhabitants would greet each other at the message board. Since not everyone is there at the same time, they leave messages on the boards, which are sub-divided into areas (sections) where messages relevant to specific topics are posted accordingly. All messages relating to a particular topic are then collected together as a 'thread' and filed in dedicated areas within a structure called the on-line library."

Another main function of the forum is the conference area where members can meet at a pre-arranged time and communicate on-line with each other about any topic of mutual interest. The regional forums are open to all employees and had similar internal structures. The major difference was in terms of language and the geographical areas served. For example, Spanish was used mainly in the

ForoLatino, which was created at the request of Spanish-speaking employees based in Latin America. English was used in the Techforum and was mainly used by North Americans. European languages (French, German and others) were used in the EuroForum for Europe-based employees. The AAA Forum used English as the main language and was open to Asian, Australian and African-based employees. The differences between the different regional forums were explained by a forum-specialist:

> "We (Buckman Labs) had different regional forums as part of the global KMS. They were basically the same in terms of design and structures, the differences lie in the language usage and context they are in."

To take the TechForum (see Figure 4-2) as an example, it had 20 sections, each with its own message board, conference rooms to facilitate debate, and library sections, where the communication threads and other pertinent knowledge were stored. The 20 sections were organised into three groups:

- 13 of the 20 sections were devoted to the business areas within Buckman Labs, for example pulp and paper, and leather, and were focused upon improving client companies' productivity.
- Six of the 20 sections were primarily internal and designed to improve the operational efficiency and effectiveness of an organisation (e.g. Human Resources, Plant Operations, Safety/Environment, KT Topics/Help).
- The Bulab News and Breakroom were general discussion sections in the Techforum where Buckman employees were free to discuss any topics of their choice.

In particular, the Bulab and Breakroom sections were considered as the "pull" to bring the whole company together by encouraging people to communicate in a more socialised environment. The diverse topics discussed in the Breakroom range from support for American football/baseball teams, international sporting events, requests sent to employees in foreign countries for vacation recommendations in their area, and the price of breakfast foods.

4.6.3 Customer-based Codified Databases

In addition to the regional forums, there were also two customer-based databases available on Buckman Labs' ICT-based KMS. Unlike the regional forums, the ChemForum and Customer Forum (CIC) databases were only accessible on a need-to-know basis. The structures of the ChemForum and CIC were similar to those of the more open regional forums.

Of the 12 sections, five were used by the R&D and manufacturing staff world-wide to discuss Buckman Labs' new emerging, un-patented technologies. In this way, proprietary knowledge was created and shared in these sections. The remaining seven sections were used by the individual business functions to share their thoughts on topics of global importance. As an engineer in the KTD explained:

> "the use of codified databases seeks to amass a wide range of organisational knowledge – from effective approaches to executing business processes to good ideas about

> serving customers. They also act as clearing-houses for basic organisational information such as policies and procedures and for more esoteric information, such as highly specialised computer-based training modules." (Internal Document, 1998)

To further understand the functions and structures of the customer-based systems, the following sections examine each of the two customer-based codified databases in detail: the Marketing Information Data Analysis System (MIDAS) and the Customer Information Centre (CIC).

4.6.3.1 Database 1: The Marketing Information Data Analysis System (MIDAS)

MIDAS (see Figure 4-3) is an electronic collection of all the available information and knowledge about Buckman Labs' customers: customers' locations, company names, company contacts, products and processes, *etc.*

Originally, according to the Vice President of Human Resources, MIDAS was developed to replace a very ineffective process of gathering market information through semi-annual surveys.

The discussions began in 1993, when a Vice President from one of Buckman Labs' industry segments had the idea of building a system that would organise more information to help sales, marketing and management forecast customer needs using structured information. A software system called MIDAS was then created as an

experiment for Buckman Labs' coating division to support the need for gathering market information.

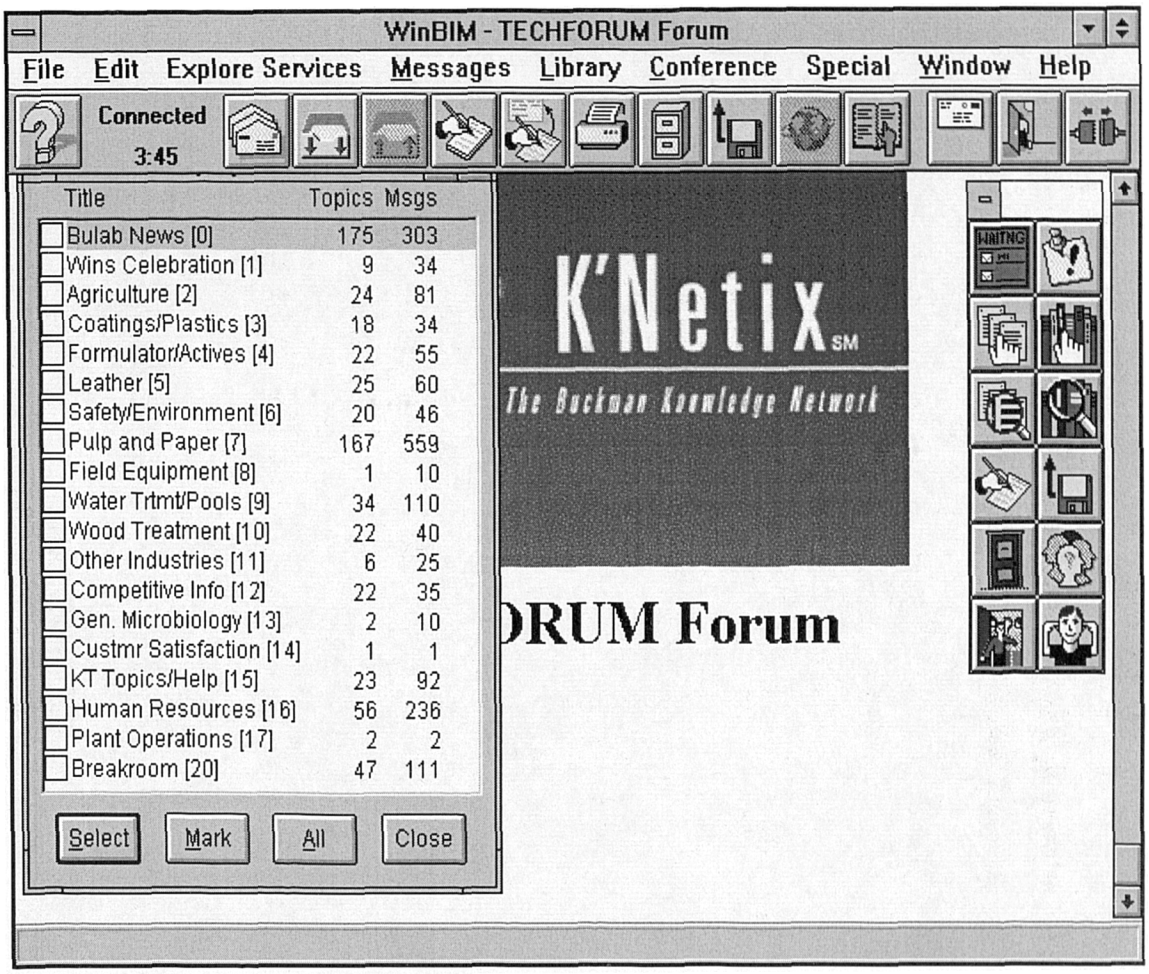

Figure 4-2: K'Netix®'s TechForum at Buckman Labs

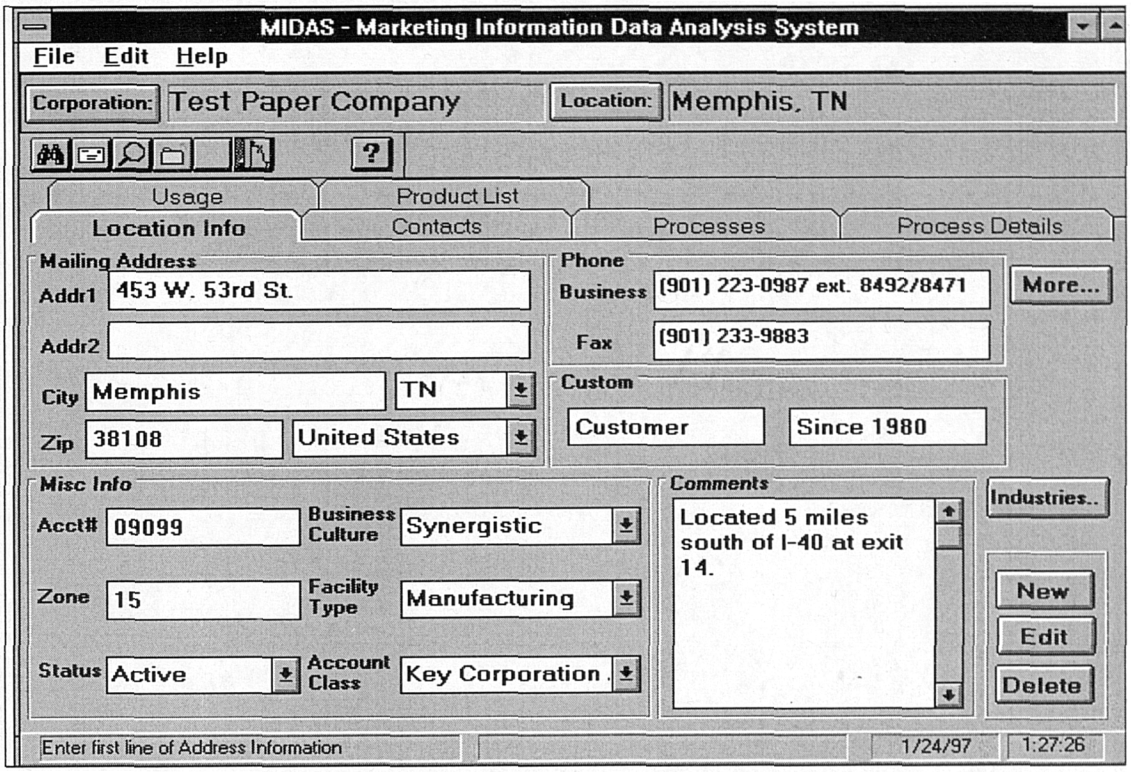

Figure 4-3: The Marketing Information Data Analysis System (MIDAS)

As one member of the sales staff explained:

> "On-line monitoring of our customer's computer and operations parameters will allow senior employees to solve problems from afar and make our younger employees more confident and effective. This is where knowledge transfer will become most valuable to both Buckman Labs and our customers."

MIDAS consists of several modules: the PC Module, Replication Module, and Management/Administration Modules. Technology in MIDAS includes the MIDAS PC module, which is a part of the K'Netix® system and uses Visual Basic and Microsoft Access. MIDAS is also written to address the customer information

needs of the specific industries that Buckman serves. Information on the client is transmitted to the central system using oracle Mobile Agent technology, where it is stored in an oracle DBMS.

According to one informant, a member of the sales staff, since its development, the application of MIDAS has proven to be extremely useful:

> "The implementation of MIDAS has been a good news for us (sales staff) in terms of information and KM. With MIDAS, I am able to access to customer information much easier. While in the past, I have relied more on fax and telephone calls for getting access to the headquarters' experts in my industry. They are only limited to the headquarters, unlike now, with a click of the mouse I am now able to get help and information from all over the world."

Most importantly, the implementation of MIDAS also provided "instant knowledge available to the employees of Buckman on where opportunities are and what knowledge is needed to make timely strategic decisions to capture market share" (a Computer engineer). Moreover, the benefits of MIDAS are not limited to the daily work of the sales force, but can also be seen in the decision-making process of management. As one manager from the KTD department noted:

> "The great advantage of MIDAS is not so much to the users and the sales representatives, as it is to management

> in being able to get a global picture of what's happening. With every person in the company putting their MIDAS data, we can then take a global look at what areas we could do better to sustain our competitive advantage."

4.6.3.2 Codified Database 2: The Customer Information Centre (CIC)

The Customer Information Centre (CIC) database uses Lotus Notes both on the PC and on the central repository to track customer-related documents. The database was designed to capture for re-use the total knowledge of the company in solving a customer's problem. It was also seen by Buckman management as a very important tool to aid their decision-making processes, as one senior US manager explained:

> "The combination of technical knowledge and practical experience allows managers to analyse and evaluate the customer's complete production process and recommend integrated treatment programmes."

The CIC is used not only by management but also by front-line sales representatives to store electronic copies of communications with specific customers, including memoranda, reports of inquiry calls and technical service laboratory reports. However, access is restricted to account representatives and their management.

The philosophy behind K'Netix® is to focus on putting power on the front line, where the strategic process of problem solving takes place. As a result, one of the

key features of the database is to allow specific customers' employees world-wide to communicate among themselves and with Buckman employees. The company has allocated one section for special Buckman customers only, and both parties are responsible for nominating employees who should be given access to this section. Associated with each customer section is a related "Buckman only" section to enable those Buckman employees who interact with customers to discuss their global strategies.

4.6.4 The Strategic Value of Organising Knowledge Sharing

As indicated in the previous sections, an important strategic value of organising knowledge sharing is shown in the commitment of Buckman employees to their customers. "Between the period of 1994-1999, the company had been able to keep net income in the 3% to 6% range, operating income from 7% to 10.5% and gross profits from 52% to 55%, in spite of worldwide currency fluctuations" (a marketing manager).

Knowledge sharing at Buckman Labs is considered to be a very useful means of gathering valuable information and ideas from customers and, in some instances, working with them to develop new products and services. One implication of such a knowledge-based culture is the emphasis on using knowledge to achieve customer satisfaction, which in turn depends on using knowledge to solve customers' problems. Successful cases have been used by the management as a tool to

encourage employees' participation and to justify investment in the knowledge-sharing initiative. To take a fairly typical example:

> "A papermill in the United States was troubled for nearly a year with a drop in pH in their starch solution. A representative used a global electronic communication network to communicate the problem to the company's paper industry experts world-wide. Using the on-line forum, the representative relayed the characteristics of the system and the unsuccessful treatment attempts recommended by competitors. Specialists from the U.S. and Europe discussed the case on-line with the local representative utilising their combined knowledge and experience to conclude that the source of the problem was most likely thermophylic bacteria. The local representative conducted further testing which confirmed the diagnosis and implemented a solution within 48 hours of being contacted." (Archive - internal document 1997: 5).

According to the management, the whole purpose of Buckman Labs in deploying knowledge at the front line was to close the gap with its customers and to secure business deals. For the Chairman, the front line and the bottom line were very much related. The ability to solve customers' problems was central to the overall objectives of the knowledge-sharing activities. As the chairman explained, the relationship between organisational objectives and customers

> "can be reduced to a simple ratio: the number of people in the organisation working on the relationships with the

> customer, relative to the total organisation will determine the momentum of the organisation."

As this manager explained further, the percentage of company employees who were "effectively engaged with the customer" was highly significant in Buckman Labs. Before K'Netix® was launched, it was only 16 per cent. By 1998, it was about 50 per cent, and Buckman management expect it to reach 80 per cent by the year 2000. The following example demonstrates how knowledge-sharing activities translate into added value for customers:

> "A steel mill in Malaysia was experiencing severe deposition problems on the moulds of their continuous casting units. A reduction in heat transfer was about to bring plant production to a complete halt. A local representative of a major specialty chemical company used an electronic communication network to transmit the characteristics of the problem to the company's technical specialists and water treatment experts worldwide by way of an open forum. Within 48 hours, the representative had communicated on-line with experts from South Africa, Europe, Brazil and the U.S., bringing the company's extensive knowledge base to bear to solve this specific problem. The problem was identified as iron deposition resulting from old corrosion by-products and an iron dispersant was recommended to eliminate further deposition problems." (Internal document 1995)

One Marketing Director further emphasised the importance of the company's customer focus:

> "To us, customers are most important. If an employee is not effectively engaged with the customer, why is he or she employed? Effective engagement occurs when an associate takes responsibility for and is actively involved with satisfying the needs and expectations of our customers so that Buckman Labs becomes the preferred choice." (Marketing Director 1998)

Despite the visible progress in gathering knowledge and expertise from its customers, Buckman Labs' knowledge-sharing efforts have been criticised by employees for being strong in solving technical problems but very weak in other social and organisational concerns (such as gathering market intelligence). As pointed out in one internal survey, 1995):

> "The system and tools we have in place are excellent -- particularly the tech forums. We do an excellent job of coming up with answers to technical problems; however we are very weak in 'knowledge' on the markets and marketing information. The Knowledge Resource Centre seems to be able to come up with technical information in a very short time, but we get limited information on business, marketing and non-technical questions."

Thus, it can be said that the establishment of the K'Netix® system has important ramifications for the organisation's ability to respond to customers. Traditionally,

for example, geographical distance has always been problematic for Buckman Labs; but this problem has been reduced since the establishment of a knowledge-transfer system. As one sales associate stated:

> "the speed of response to customers is typically hours, rather than days or weeks. In other words, Buckman Labs have effectively moved the entire organisation to wherever it is needed at any point in time. The speed of response for customer queries has improved considerably."

While implementing global knowledge sharing has provided strategic value for Buckman Labs' business relationships with its customers, the company's efforts in organising knowledge sharing have not been without difficulties and controversies.

4.6.5 The Global Knowledge Sharing Process

Having explained the nature and background of Buckman Labs' knowledge architecture, and the strategic value of knowledge sharing for its customers, the next step is to consider the global knowledge sharing process. One way of achieving this is to examine a typical problem-solving situation. When a request for help is sent to the KMS, the following steps usually take place to ensure that knowledge has been created, processed, stored, disseminated, and prepared for use and re-use. K'Netix® is not a static repository (Figure 4-4). A feedback loop has been set up so that, after listening to customers, any queries relating to a particular area that cannot be answered by the technical-sales person/field-based employees

are posted on the forum. Usually the request for help is answered by anyone who has expertise in the related subject area.

If the request is unattended for a few hours, a specialist knowledge processing team will intervene and facilitate the process. Two scenarios can emerge. First, one of the forum specialists will pick up the request, identify the potential experts and try to get their attention in order to answer the question. Secondly, a team of experts with related industrial experience may volunteer to be listed as 'section leaders' to help answer any requests and prepare weekly summaries.

The specialist knowledge-processing team set up by Buckman management to facilitate knowledge sharing was critical in ensuring that the knowledge generated from the CoPs was accurate and that the system designed by the IT department is user-friendly. This involved not only information technologies but also individuals that could organise, analyse and verify the integrity of knowledge that has been fed into the system. Members of the specialist knowledge processing team included a number of forum specialists (KRC) and section leaders (two or more per section from various departments). This virtual team was put in place to reduce the need for each associate to retrieve and store the accumulated knowledge that each section captured as a result of discussions within the sections and stored as text-files in the appropriate section library. Forum specialists usually possess good communication skills and act as 'cheer leaders' as well as co-ordinators in facilitating the knowledge-sharing process. As one specialist explained:

> "My job responsibility is to read all those messages, make sure that they responded to or to be active and put information and new knowledge into that section." (E-mail discussion conducted on-line, November 1997)

On the other hand, a section leader is usually a highly trained chemist or microbiologist with specialised industrial knowledge and experience. Section leaders are individuals who are already well known to many in the organisation as experts and leaders in their respective industries. They are authorised experts from different areas of the organisation who act as a key source for unanswered requests or unsolved problems.

According to a specialist,

> "section leaders are selected initially to lay a foundation of trust in the solutions which employees are sharing. They are then trained on the system (either in person, or interactively online) and are expected to enter the forums daily to review any messages and respond accordingly."

The section leaders write abstracts for a central database accessible via the CompuServe forum. This spares others the drudgery of reading through the records of an entire conversation. In other words, they are not only responsible for facilitating the knowledge-sharing process but are also needed to 'process' knowledge, e.g. by writing abstracts for storage, and facilitate the re-use of the obtained knowledge. Moreover, it is also recognised that there will be times when

the competing pressures of business will make it impossible for employees to review the contents of the forums in great detail. To alleviate this problem, members of thc specialist team assume the additional responsibility of preparing a summary of the discussion points that occur in each section and of posting the information at the end of each week. This ensures that topics of discussion that do not warrant capture and storage in the libraries as text-files are not lost and are available for future use.

After an information search is completed, responses are then formulated and presented to customers for problem solving. The request will remain in the forum as long as there is an active discussion of it, and will only be extracted for knowledge processing when the issue is considered to be 'dead'. As a result of the discussion of the request, which usually generates new knowledge with the help of the forum specialists and section leaders, the new knowledge then goes through various processing activities. For example, the knowledge generated is usually overlapping and sometimes inaccurate. Therefore, forum specialists and section leaders will need to organise, validate and verify the knowledge before it is uploaded, stored into the knowledge base and is ready for distribution and use/re-use if a similar query is requested in the future. These processes enable the tacit knowledge of experienced people to be shared within the organisation on a world-wide basis. More importantly, they allow front-line employees to continue serving customers while a specialised knowledge processing team devotes time to capturing their knowledge into a re-usable form.

4.6.6 The Types of Knowledge Shared at Buckman Labs

The types of knowledge that are shared and transferred at Buckman Labs encompass customer knowledge, competitive intelligence, the processing of knowledge, and product knowledge. In the context of this study, these may be conveniently categorised as factual and behavioural corporate knowledge. The former consists of technological and market know-how based on the accumulation of structured information and is transferable in formalised processes (Richter and Vettel, 1995). The latter, which lies beyond simple transferability from one department to another, includes mind structures co-ordinating the social interaction of individuals within organisational boundaries. Also crucial in most specialty chemical organisations is their proprietary knowledge, which is protected by patents and trade secrecy, and is codified and can be subject to licensing and commercialisation. Tacit knowledge is implicit in the professional and institutional culture of a firm (Gibbons *et al.*, 1994).

Having described the basic components and the background of K'Netix®'s development, and the global knowledge sharing process, the next task is to examine the interactive aspects of organising knowledge sharing at Buckman Labs.

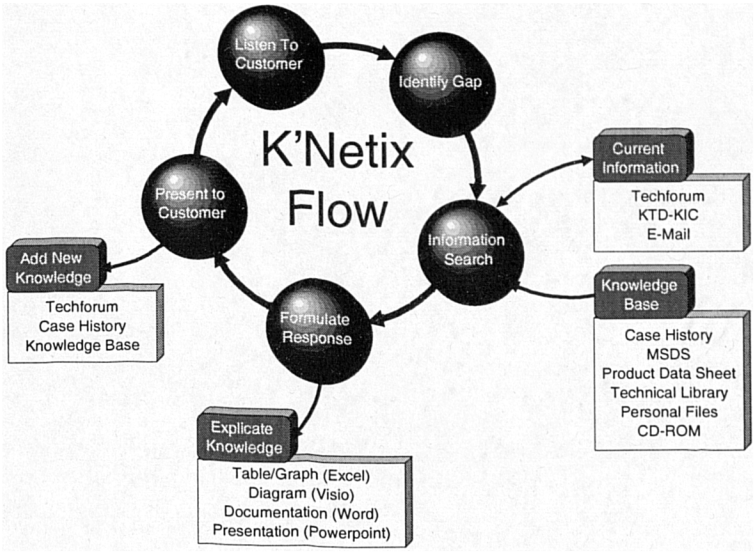

Figure 4-4: The Knowledge-sharing Process at Buckman Labs (Source: Buckman Internal Document 1998)

4.7 The Interactive Aspects of Organising the Knowledge-sharing Process – Socio-technical Interrelationships

In the context of the present research, there is a need to understand the softer issues of social interactions surrounding Buckman's global knowledge-sharing efforts. However, before this study presents the interactive aspects of organising the knowledge-sharing process, a real-life example of global knowledge sharing is shown below to demonstrate the complexities involved in organising knowledge sharing.

The example concerned the need for specialist knowledge on pitch-control, which involved removing or minimising the effect of pitch (or 'stickies') in the papermaking process. Pitch is made up of sticky materials left over in the pulp fibres used in the papermaking process or contributed from adhesives or plastics in recycled fibres. Given the range of business activities Buckman Labs was involved in, there were frequent demands for knowledge in new or esoteric domains. In this instance, an employee who was based in Singapore as a Managing Director in Asia needed some technical expertise for a business proposal bid to an Indonesian pulp-mill. He sent a message through the K'Netix® system for help on how he could go about preparing the business proposal. The first response came three hours later, from an employee in Memphis, and included a suggestion to use a specific Buckman chemical and a reference to a student's thesis on the pitch control of tropical hardwoods. The second response came 50 minutes later from Canada, offering an experience on solving the pitch problem in British Columbia. Then another employee logged in with examples from Sweden; as did an employee from New Zealand; and others in Spain and France. In all, the request generated 11 replies from six different countries, stimulated new discussion, generated new knowledge, and enabled the Managing Director in Singapore to secure a US$6 million order from an Indonesian pulp mill (Buckman, 1998).

This fairly typical example of global knowledge sharing also demonstrates the key role of the infrastructure in shaping the K'Netix® network's capacity to connect knowledge suppliers and knowledge users on a worldwide basis. At the same time,

the structure, with the implicit norms and protocols attached to both requesting and supplying knowledge and information on this specialist topic, was also vitally important. In addition, there was the diffuse but hugely influential impact of the social issues. The core values and attitudes of Buckman employees were reflected in their willingness to exchange knowledge to solve company problems without the usual political baggage and ulterior motives (VP HR – 1998).

The following sections aim to highlight management's efforts in managing the resistance to change that took place in the early stage. In particular, the effort to achieve a continuous process of cultural change is presented.

4.7.1 Managing Resistance to Change

While the organisation of the integrative aspects of knowledge-sharing activities (the adoption and implementation of an ICT-based KMS) at Buckman Labs was fairly successful in the initial stage of the implementation process, there were organisational problems and tensions that managers had to address and overcome. One of the first managerial challenges for Buckman management was that of managing resistance. For example, when asked about the main reasons why some employees resisted the idea of global knowledge sharing during the earlier period, one informant in the Singapore office suggested:

> "To me, the main obstacles to knowledge sharing are the intangibles, starting with people themselves. As the evidence suggests, with today's technology, getting equipped (putting time and investment into research, buying/setting up equipment, etc) is just the first hurdle. This is a 'tangible' obstacle. Getting people to use the 'new thing' is another complete challenge altogether. It will take a combination of many things besides the obvious, like training, and motivating, and leadership." (An on-line discussion with a Singaporean employee)

The resistance started soon after the technological components of the global KMS were introduced and implemented in 1992. An increasing number of social and organisational problems began to emerge and attract the attention of the management. By 1993, management at Buckman Labs had realised that further organisational and cultural changes were essential. In particular, Buckman management realised that the organisation must make a dramatic and potentially traumatic shift affecting the very fabric of the organisation: the design of work, the work environment, technology, reward systems, structures and policies must all radically change. The management were also convinced that successful knowledge-sharing involved more than the adoption of IT, and that subsequent organisational change must be nurtured and carefully managed, although this was bound to encounter obstacles, especially the rigidity of the old mindset of employees. This particular tension was evident in the early implementation stage of the knowledge-sharing activities, as one long-serving scientist from the R&D department explained:

> "Most everybody is willing to share knowledge on a face-to-face basis (one to one) because there is the belief the sharing will lead to a sale which will in some way provide a reward. What we see also is a reluctance to do so via the knowledge network, this is because there is a disbelief that 'the most powerful people are those that share knowledge' especially when they do not see rewards of doing it."

Thus, Buckman Labs' efforts to facilitate a knowledge-sharing culture began with a programme of 're-learning'. As the company's 1997 annual report stated:

> "We have developed within our company a knowledge-sharing culture where individuals are building teams across time and space to solve problems and create value." (Buckman Annual Report 1997: 20)

The process of 're-learning' was necessary, as most previous training had educated employees to believe that success depended mainly on the hoarding of knowledge. As a result, the facilitation of cultural change for Buckman management was fairly difficult. As confirmed by the Chairman, "Building and facilitating a knowledge-sharing culture was perhaps the most difficult part of Buckman Labs' experience in organising knowledge sharing". As another HR manager added:

> "It is sort of like shifting your organisation from what has traditionally been a structured organisation to one that's much more free flowing in terms of knowledge and people."

When the new philosophy of KM was first introduced, a clear message about the importance of knowledge sharing was sent out to all employees by the top management:

> "with the practice of global knowledge sharing, the access of information and knowledge flowing now points to the real value being created by those who can provide timely access to accurate information and knowledge." (An informant)

In other words, Buckman employees were encouraged to speak freely about their opinions, even if this meant going outside of the chain of command. As one informant recalled:

> "With the global network in place, it does not matter if you are a sales associate, a regional or district manager or a corporate VP- everybody talks to everybody."

However, despite the clear message from the top management, the radical cultural change introduced by them had strong implications for the power structure of middle management. In particular, there was an apparent lack of communication between top and middle management that caused further difficulties in managing the resistance. According to one informant:

> "Part of Buckman Labs' past success had been relied on the commitment and collaboration of top and middle

> management. Traditionally speaking, Buckman's middle management have been considered by the organisation as the 'go-between' in many of our strategic implementation processes of the past. We regard them very highly. I must admit, in the case of implementing global knowledge sharing, they must have felt left-out in the implementation stage earlier."

According to another informant, there is no doubt that the top management of Buckman Labs understand the value of KM and support the development of programmes and policies to make it work. They also appreciate the notion that knowledge leadership involves more than investing money in, and giving verbal support to, a KM initiative. Furthermore, they (top management) also recognised, in a long run, the development of a knowledge-sharing organisation requires a combined top-down and middle-up-down approach. Unfortunately, the need to involve middle management was neglected by Buckman top management when the knowledge-sharing initiative was first implemented in 1992. As one middle manager pointed out:

> "When it was first introduced, we (middle management) were almost completely ignored in the decision making process as well as the implementation process. As I remembered, they (top management) made some efforts in explaining to employees on the purpose and the benefits of organising global knowledge sharing. However, we were not informed about the role of middle management would play in the process. More importantly, we felt like we

were going to be made redundant as a result of the particular knowledge sharing initiative in a long run."

In other words, there was resistance towards the notion of knowledge sharing within the organisation, especially from middle management, which had previously been almost totally ignored by the senior management in facilitating cultural change, and whose position in the power structure now seemed to be threatened. Just such a problem had, allegedly, resulted a number of middle management to walk out and left the company as their future with the company became unclear to them. This was understandable, as they were traditionally perceived as information gatekeepers. As one middle manager put it:

"The requirements for KM ran parallel to the norms of the corporate culture, where people found ways to fortify their worth through the control of scarce information."

Unfortunately, such inattention was not dealt with until much later in the process. This could perhaps help explain a series of social and organisational problems that arose. As one middle manager pointed out:

"We (middle management) were less enthusiastic about this particular initiative even from day one. We did our share to participate in the process, but we have not been motivated in promoting this particular activity. Maybe, it has to do with the fact that we were not involved, nor our

> concerns were really addressed since the beginning of the implementation."

As the resistance by middle management continued to emerge and was making the implementation difficult, the top management decided to adopt a mix of reward (carrot)-and-punishment (stick) approach. Incentives were offered, e.g. by promoting some of the middle managers who had actively participated in knowledge sharing activities to senior positions. On the other hand, the "punishment" component was also pervasive. In the early implementation period of K'Netix®, the chairman would actively participate in the on-line discussions to set an example, and communicate face-to-face to those employees who were not willing to participate in the sharing activities. As an middle manager described:

> "I remember once the chairman came into my office and asked why I have not been actively participating on-line. He asked if I was encountering any difficulties, and had offered training if I needed them. On the other hand, he made it quite clear to me that global knowledge sharing was part of his future vision for the company. After that, I knew it was going to be quite clear that I would need to participate (in knowledge sharing) more than I had".

One issue that stood out in the process was top management's success with using 'soft-warnings'. This particular 'stick' strategy worked better in Buckman Labs than it would in other public firms because of its family-owned nature. There were 200 shareholders including employees, directors and outsiders. Mainly, the

chairman and a handful of its top managers owned the largest block of stock of the company. Although not limited to only using this 'stick' strategy, Buckman's top management was able to establish authority in convincing its employees to adapt and adopt the new knowledge sharing philosophy.

To sum up, the adjustment or "re-learning" process was painful and strenuous, especially for middle management. Undoubtedly, the fairly difficult experience of dealing with resistance to change can be attributed to top management's initial failure to recognise the nature and scope of the problem, and their 'reactive approach' towards overcoming the communication difficulties stemming from different communities of practice.

4.7.2 The Emergence of Communities of Practice

While the problem of resistance from middle management was continually being monitored by the top management during 1994-1997, the emergence of communities of practice had also been brought to the attention of the management. This emergence came about as the adopted technology has expanded communication capabilities across time and space in the organisation. In particular, the way in which Buckman employees communicate has been altered by the introduction of Buckman Lab's global knowledge network system. For example:

> "The old 'smoke blowers' are no longer listened to and can now be intelligently eliminated from the organisation. People are more interested in listening to people who have something intelligent to say, and their influence is growing." (Chairman 1998).

Moreover, such change has also created communication problems resulting from the emergence of CoPs, which has had positive impacts, at least in some cases, on the way knowledge is shared and transferred within the organisational boundary of Buckman Labs. As one informant in the marketing explained:

> "Overtime, the introduction of K'netix has created communities throughout the organisation. Employees who share the same kind of interest or expertise were drawn together, not organised by their functional departments but by a sense of common knowing and interest."

CoPs have been identified as having played a major role in Buckman Labs' attempts to organise global knowledge sharing. In particular, their role in facilitating an environment for the interdependency and interplay of tacit and explicit knowledge was the key to global knowledge-sharing activities. According to one informant, knowledge within a community is not retained in the form of a cognitive structure or plan of action. Rather, it is captured in customs or 'usual ways of doing things'. Specifically, in his understanding, knowledge within a CoP and its ways of perceiving and manipulating objects are encoded in artefacts, with technology performing an enabling function. In another account, one section leader

explained how he utilised the collective knowledge of a particular CoP in solving a problem for a fellow employee:

> "There was a question posted by someone in Mexico requesting some advice on a particular chemical problem. It was a fairly complex question, as I recalled. It took a joint effort of six employees in four countries by providing both text files of a specialist research and experiences of two employees with 20 over years of experiences. In the end, we were able to solve the complicated problem mainly because we trusted each other and saw ourselves as part of a community, like a family. We came up with the solution fairly quickly also because we were able to encode and interpret the problem rather easily using our common background in chemical treatment."

The formation and emergence of CoPs has also positively reduced the communication barriers between branch offices in different parts of the world. By moving towards facilitating a trust environment for knowledge sharing, Buckman management initiated a number of changes (to be discussed later) to allow open communication with universal access to the KMS, thereby cutting across the boundaries of geography within the global organisation. As one manager explained:

> "For Buckman to be truly successful as a global company, all employees must view themselves as part of that global community and not the US or Europe or Asia. The forum is an integral part of that global mentality."

The concept of CoP also allowed Buckman employees to understand and appreciate the processes by which the transmission of tacit knowledge and of knowledge-in-action takes place. In the opinions of some Buckman employees, a CoP is best seen as set of relationships among persons and activity over time and in relation to other overlapping CoPs. As one informant explained:

> "we feel that we belong to a community that shares common interest in quality issues. Overtime, the community is not created by the management nor the members but by the shared manner in which we conduct businesses and interpret quality issues. The idea of the community is not geographical but spiritual."

In terms of what makes a successful CoP, a number of key factors were suggested by a HR staff. First, for any CoP to evolve within the organisation, an environment that is seen as trustworthy by most participants is crucial. Trust is seen as a vital "lubricant" of knowledge sharing (Scarbrough and Swan, 1999) in Buckman Labs. As the Chairman put it: "This is the most difficult aspect of knowledge-sharing to achieve. If you can't do it, you can't succeed". While recognising that people grow up learning to hoard knowledge to achieve power, Buckman managers made efforts to foster a culture of trust, encouraging active knowledge sharing across time and space among all of the company's employees. As further explained by the informant:

> "Our company's success in fostering a trustful environment was based on a common understanding of the nature of knowledge. This was related to the recognition of the importance of tacit knowledge and the difficulties involved in trying to codify it. The Buckman management recognised early in the process that creating new knowledge involves not only objective, external information, but also tacit and highly subjective individual insights, intuitions and hunches."

Secondly, Buckman management appreciates that all workers are knowledge workers. From their perspective, the responsibility for creating and sharing knowledge resides not only in the R&D department, but also situated in the social interactions of CoPs in the organisation. All employees were expected to be knowledge creators and sharers:

> "We (top management) spent a lot of time and effort in emphasising to our employees world-wide that knowledge is a product of collective efforts. It is not just limited to the scientists in our R&D department, although they play a big role in many of our problem-solving situations, it is everyone in the organisation whose involvement, experience and knowledge that might help form the best solution to our problems." (a senior manager)

Thirdly, a knowledge-entrepreneurial environment, in which employees are encouraged to share their knowledge on-line, is also important. Accordingly, over time, Buckman's trust environment within and among the CoPs has encouraged

everyone to become knowledge entrepreneurs. This facilitative climate has helped employees to take risks, innovate and get out of the habit of asking for instructions. Knowledge entrepreneurship is rewarded, and inquiry and innovations are promoted within Buckman Labs. Some recent managerial promotions, for example, were based on the managers' continuous active participation in knowledge-sharing practices. As pointed out by one senior manager:

> "I am one of the two recent managers who have been promoted recently. I would like to think that I have done a good job in the functional area (sales). However, I must admit that my performance in sharing knowledge on the Intranet over the years might have played an even bigger role in my promotion."

Fourthly, universal access is another key to the success of the CoPs. In the early implementation stage of organising knowledge-sharing initiative, Buckman Labs was determined to provide all employees with access to K'Netix® by the end of the first year (1993), since it had spent over US$8 million dollars on hardware and software. The importance of universal access was evident in one previous incident where there were on-line discussions about a compensation problem concerning a special bonus award that was given each year to selected salespeople from around the company. In this case, the universal access capability of the system enabled members of the particular CoP (mainly salespersons) to engage in trading and exchanging opinions and information.

To sum up, Buckman Labs' accessible, trustful and entrepreneurial environment meant that employees were permitted to organise their activities within CoP boundaries while ample resources were also made available to them, such as free access and unlimited connection to the Internet and Intranet. In other words, it was a combination of structural and cultural factors that nurtured a trust relationship within and across CoPs.

4.7.3 Communication Inertia

On the other hand, despite the early success with the emergence of CoPs in organising knowledge sharing, there was still an apparent lack of inter-community knowledge-sharing activities. In most cases, global knowledge sharing was limited to the regional forums. In other words, questions raised by individuals belonging to a particular regional forum were usually only answered by people in the same forum. Clearly, there was a set of communication problems emerging from the Buckman forums, especially those outside the USA. According to one informant in the Learning Centre:

> "The nature of the barriers in our international-based forums is three-fold: Technological, Communicational and Cultural. For example, in South Africa and Brazil, the primary problem is information technology. On the other hand, I think our main problem with EuroForum could very well be communicational."

Initially, the communication problems were thought to be technological. However, they were later perceived as cultural and organisational. The problems were evident in Buckman management's dilemma in choosing the design of global forums. In 1992, with the introduction of the KMS (single forum design) and the philosophy of global knowledge sharing, the first communication problem encountered was that of language. When the system was first introduced, there was only one global forum (the US-based TechForum). By March 1994, although the single global forum design had worked well in terms of Buckman Labs' knowledge-sharing philosophy, the design had not been well received by overseas employees. In particular, they commented that they were uncomfortable asking their questions in English, although they had no problem understanding the feedback they received in English. Therefore, to encourage employees outside the USA to participate, management introduced a new policy:

> "Bulab employees should feel comfortable using any language they desire when posting messages to the message board. The Sysop(s) will follow the addendum to the Sysops manual and see that the message is translated into English for all to read. Technical replies will be translated back to the originator's own language in accordance with the addendum." (On-line archive 1997)

In addition, three translators were hired to do the translations within 48 hours after messages were posted. In practice, this policy proved to be inadequate to deal with the problem. This was because the root of the problem was cultural rather than linguistic. As one supporter of the establishment of regional forums commented:

> "The 'international' forums seem to provide a space where a higher degree of participant comfort is achieved based on the cultural and language similarities of the specific forum. This 'comfort' is extremely important if effective communication and interaction is to be realised. I'm sure the Sysops and Section Leaders move and translate messages of relevance to other forums as they deem necessary. Sure, it seems to decentralise the knowledge base a bit, but I would hope this is compensated for by the additional participation by employees in other countries."

4.7.4 The Use of Common Languages and Metaphors

Indeed, according to some informants, it was not the nature of technology that created dysfunction and divisions in communication; rather, it was the lack of a shared language and understanding within the CoPs. For example, in one particular incident, a senior manager who had previously been perceived by the members of the CoP as a non-supporter of the knowledge-sharing initiative suddenly decided to voice his disagreement in an on-line discussion which lasted for weeks. Such unexpected participation by the top management put off a number of people and led them to stop participating in further discussions, at least for a while.

In addressing this problem, two initiatives (the use of the 'Waterline' metaphor and the development of a Code of Ethics for Internet Use) were developed in an effort to facilitate a knowledge-sharing context. A new philosophy that "anything was discussible and anyone could participate in the CoP" was developed and made known to Buckman employees. Top management took time to explain to the employees that the company was made up of individuals, each of whom had different capabilities and potentials, but all of which were necessary to the success of the company.

Despite the popular reaction to the introduction of the philosophy as a flexible guideline of global sharing behaviour, many Buckman employees were still not very comfortable. As the management suggested, such uncertainty was probably due to the 'transparent' nature of the global KMS. As a result, Buckman employees were hesitant to communicate because of not knowing 'what was right and what was wrong'. Subsequently, the Buckman Code of Ethics was introduced by the management to provide precise guidelines to employees on participating in global knowledge sharing. Captured on a wallet-sized laminated card and passed out to every person in the company, it stipulated a new operating philosophy embracing a common language and understanding.

As a result, in order for the philosophy to work, a new metaphor ('waterline') was further introduced and implemented by the management. Buckman employees were

asked to think about the company as a ship, with the Code of Ethics as the waterline. According to the Chairman of the organisation:

> "You do not shoot below the waterline, because you can sink the ship. However, you are free to be as innovative as you wish in changing the superstructure of the ship to meet the needs of the customer."

In making sure that employees understood this metaphor, a double-edge approach was adopted by the management. First, an on-line promotion strategy was used. In particular, a lot of effort went into explaining the meaning and the practicalities of the metaphor. Top management, as well as some middle management, were encouraged to participate in promoting the metaphor on-line. As recalled by one informant:

> "I could still remember how the metaphor of waterline was promoted and explained on-line in an effort to encourage us to participate knowledge sharing. When I was first introduced to such a concept, although without the clear guidelines of dos and don'ts, I thought it had given us a lot of flexibility in terms of how we should behave on-line as Buckman employees. It has made participation easier. I think."

Secondly, in the initial stage there was intensive on-line participation by management. In one incident, the Chairman himself engaged in on-line discussions in an attempt to convince Buckman employees that the company was serious about

the initiative and to explain how should be carried out. Any 'misbehaving' participants were also singled out and 'punished'. For example, as explained by one forum specialist:

> "There was an employee who made some close-to-racist comments regarding our international employees was punished for his misbehaviour. His comment was taken off-line at the suggestion of our management to protect the integrity of our employees in a particular region. He was further stripped-off his right to use the K'netix for a period of few months, in a hope that he and other employees could learn how one should not participate on-line."

4.7.5 Cross Cultural and Linguistic Differences in Global Knowledge Sharing

In retrospect, although the introduction and implementation of common languages and metaphors were helpful in shaping the emergence and formation of CoPs, other types of communication problems, mainly cultural and linguistic, continued to emerge. As more and more employees from outside North America voiced their discomfort in using English as the medium of communication, management realised that the only feasible response was to establish regional forums, starting with the Latin American ForoLatino. Calls to set up more regional forums followed:

> "The sales foundation of our organisation seems to be on another network-voice mail. A large percent of our sales,

> and expertise, is concentrated in North America but these employees seem to share a large portion of their information via either direct contact, or telephone. Knowledge sharing is just one of the areas I believe we need to internationalise." (An informant)

Subsequently, the EuroForum and AAA Forum were established. As a result, a multiple regional forum strategy was adopted to overcome the communication barriers arising from employees' cultural and linguistic diversity. The response of employees to this move was extremely positive.

However, the communication problems did not disappear. The decision to move towards a set of regional on-line communities led to other difficulties in the period 1995-1997. These mainly concerned the redundancy of solutions provided by different forum participants, and also the formation of different on-line communities, a trend that contradicted the original philosophy of genuine global knowledge sharing. For example, for an employee in Brazil to obtain so-called 'world-wide Buckman expertise', he or she would need to post the question in four different forums. In most cases, this proved to be an inefficient method. Moreover, it also caused inconvenience for all and was identified as the probable cause of the decline in the usage of on-line forums during this period. This was brought to the attention of Buckman management when one US-based associate expressed his preference for a proposed single uniform forum to replace multiple regional forums spread over five continents:

> "It is my understanding that the Techforum was created to provide a vehicle by which our global company could communicate and share information. Now I see that we have an Euroforum and an Asia forum, etc. This segregation appears to be a contradiction to the original intent of global communication. I like the concept of one forum and one company, sharing ideas, knowledge and wisdom."

This comment later triggered a series of long heated debates on the Intranet involving employees of all ranks and from all regions. According to one member of the US-based forum, initially the question was thought to be a simple technical problem, resolvable by implementing real-time replication software. However, the cultural issues again surfaced as the main factor behind communicational problems.

As the discussions continued and evolved into a series of debates over the cultural and linguistic differences between European and American employees, the importance of recognising diversity in a global organisation became increasingly apparent. For example, one European staff member working in the company headquarters pointed out that:

> "What works in the US does not necessarily work in Europe, Latin and South America, China etc. This is called diversity! This also means a little more effort than undergoing cultural or diversity training is needed. A global company doesn't mean necessarily that we have to be 'one' company, have to have 'one' forum, it means

> communicating with each other, accepting differences and trying to make compromises."

Moreover, as some of the overseas employees observed, with almost all KM hardware and software designed and implemented by/from the KTD in the US, there seemed to be a gap between the headquarters and regional forums on what was expected and what was achieved. It was suggested that knowledge-sharing tools were designed according to the needs of the US-based forum without taking account of the needs of other regional forums. All these dilemmas and difficulties pointed to an urgent need to readdress Buckman's global knowledge sharing strategy. As one senior manager commented:

> "although the establishment of different regional forums seems like a good idea to most of the management and encouraged participation in the initial stages, it was found that participation on the forums became segregated and complicated."

By the end of 1997, a strategic decision was made by Buckman management to re-organise its forums into a single global forum using new software and with an enhanced translation capability. In the long run, this shift was regarded as the key to dismantling the communication barriers that had built up in the company. As the Chairman explained:

> "we started with one global forum (TechForum), then we went separate, tried to meet individual needs. Now, we are going to bring it all back together, which will make it easier for the people who are using it."

Under the new system (which was not in place until late 1998), there is a single global forum divided into different lines of business. For example, an employee from the water industry in Asia now only needs to communicate in one forum instead of the previous four forums.

In retrospect, it is clear that Buckman Labs' approach to the implementation of its KMS, at least in the first few years, overemphasised the technological aspects and the need to develop a systematic KM-focused HRM was ignored. On the other hand, while efforts to improve the global KMS and knowledge-sharing process continued in 1996, Buckman management faced two major challenges in providing organisational learning and training needs worldwide. First, they had to bring new skills and knowledge to employees in a cost-effective manner; and secondly, they needed to provide their employees with more opportunities to receive electronic learning events. Therefore, as a result, an on-line Bulab Learning Centre for human resource development was established.

4.7.6 The Development of the On-Line Bulab Learning Centre for HRD in 1997

Apart from providing systematic rewards for knowledge sharing, the Buckman management decided to create a multi-lingual, on-line Bulab Learning Centre for human resource development (HRD) as part of the KM-focused HRM strategy. Building on its maturing ICT platform and knowledge-sharing environment, the company began experimenting in 1996 with Lotus' novel educational product LearningSpace™'. This allowed employees to increase their knowledge through Intranet-based learning and training. It also helped to keep track of customer service calls and needs.

Prior to this experiment, Buckman Labs began producing computer-based training (CBT) programmes to provide self-paced, anytime, anywhere course materials to their employees in 1992. These programmes were produced on a course-by-course basis. In 1995, the Distance Learning Team was formed to expand and centralise distance learning efforts. This group laid the foundation for the Bulab Learning Centre, which was set up to co-ordinate the delivery and administration of electronically distributed educational and training programmes for the personal and professional development of employees. It encompasses learning opportunities ranging from short training courses to advanced academic degrees.

The original purposes behind Buckman Lab's distance learning efforts included the need to reduce the duplication of training efforts among technical experts and the

need to make training consistent across associate companies. The use of CBT to train employees has provided the company with a sales-force that is better prepared to solve customers' problems. It has also

- enhanced learning/training opportunities;
- reduced training time for new recruits;
- empowered employees to engage in personal and career development;
- created a knowledge advantage over competitors;
- produced a value added benefit to sell to customers;
- ensured globally standardised training;
- reduced time away from customers.

(Source: Internal Document -1997: 3)

In order to deliver these benefits to employees, the development of the Bulab Learning Centre was linked to three primary goals. The first was to provide a co-ordinated training and development function within Buckman Labs. The second was to leverage the available technologies to deliver training and development efforts in a cost-effective way. Thirdly, the Learning Centre was to play a critical role in keeping employees up-to-date with their profession (Ellis 1998). To make the objectives of the centre clear, a mission statement was created which focused on the success and development of employees:

> "The Bulab Learning Centre will support the corporate mission by delivering, developing, and facilitating world class training and educational opportunities, when and

> where they are needed. We will empower employees to manage their personal and career development, create competitive market advantage and engage customers with our products and services." (Ellis, 1998: 190)

One of the key elements in establishing the Bulab Learning Centre was the use of ICT for global information and knowledge dissemination. The use of computers in employee training and learning is considered by some researchers as both cost-effective and a powerful learning method (Whalen and Wright, 1998). The choice of ICT for the Centre has implications for the cost and convenience of the existing Intranet system. According to one computer engineer at the Centre:

> "Because the responsibility of the learning Centre is to provide and deliver learning opportunities, the infrastructure should be built alongside the existing system -- that way it could ensure minimum systems training and time spent on design and technical issues."

As a result, tools such as Lotus' Domino™ and Microsoft's FrontPape™ were used to facilitate design and content modification. The decision to use these particular forms of software was also driven by the central belief that in using information technology, content and learning objectives should drive the technology employed, and not vice-versa.

Once the choice of software was made the Learning Centre project team had to decide on the issue of delivery options. The team had to choose between

asynchronous, synchronous and instructor interaction. The key factor in making this decision was the type of content that was to be delivered. As the Learning Centre put it: "Given the dispersed nature of our employees, our bias has been the choice of asychronous delivery tools over our corporate Intranet". Asynchronous Internet-based training was selected and facilitated through the use of tools such as Lotus Notes and LearningSpace Learning within the environment of virtual collaboration. The cost and speed of distribution are always important issues in relation to virtual training delivery. According to one computer engineer, the main advantage of using asynchronous Internet-based training, since many of the courses offered are text-downloaded asynchronously, is that it tends to use less access bandwidth than the real time instruction approach. On the other hand, real-time communication requires more capacity. The bandwidth availability required by offering real-time courses may also limit the type of courses to be offered. Another reason for not choosing the real-time option is that it would restrict the availability of employees for training.

Although the scheme is still in its very early stages, more and more Buckman employees are signing up for the virtual Learning Centre courses. The Centre has begun to provide continuous training and learning for the CoPs which form around issues and then disband when those issues are resolved. It is widely believed at Buckman Labs that all future training of virtual workers working in a knowledge-intensive environment is likely to be conducted via Internet-based or other computer-based alternatives.

4.7.7 On-line Training

As already mentioned, one of the major tasks of the Learning Centre was to provide job-related training via the company's Intranet. Some employees regarded this as a natural development:

> "An evolutionary step from traditional training departments is the growing realisation and acceptance that learning need not happen in a centralised location in front of an instructor." (Director of the Learning Centre)

Not only did the sales employees welcome the initiatives; non-technical staff members were also excited, as they had not previously been offered any opportunities for further learning. As one non-technical associate commented:

> "For non-sales employees learning is left to ourselves. I have not in five years been on a further training or education course specific to my job funded by Buckman. This may be available if I asked, but I have never been informed of a further education programme being available to employees. To support the front-line I do ensure I read and learn, as much as time allow, information on new products new applications *etc*, and regularly read forums to gain knowledge by osmosis. This on-line learning is a great news for me." (Internal survey 1995)

Despite the groundbreaking efforts in establishing on-line learning and training programmes, not all Buckman employees were convinced by the function of the Bulab Learning Centre:

> "We need to do a better job of hands-on learning and 'mentoring' in field applications. All the access in the world won't help if the representative does not know what question to ask." (Internal survey 1995)

To address some of the concerns relating to the establishment of the new learning centre, it was made clear to Buckman employees that the philosophy of the Centre went beyond the traditional notions of classroom and teacher. It was developed as the organisation's response to changing external circumstances as well as being part of the continuous global knowledge-sharing initiative. As the Director of the Learning Centre explained:

> "The Bulab Learning Centre is founded on two basic strategic assumptions. First, that Buckman's competitive advantage resides in the collective knowledge of its employees, and second, to sustain that advantage the company must invest in the skills and competencies of our employees." (Director of the Learning Centre 1998)

Still in its very early stages, the Bulab Learning Centre's efforts are focused upon increasing the knowledge content that resides within each associate. In particular, the focus of the Centre is on researching and acquiring the necessary training

materials. Since 1997, Bulab Learning Labs has been working with content providers such as universities from specific geographical areas to enhance the flexibility of its training courses. As one manager at the Learning Centre noted:

> "We're also offering the ability for our translation group to partner with certain content providers to actually translate their existing content and the determine how we could, how we could barter that service back into advantages for the content provider as well, because then, we could effectively provide them a translated copy of their material and expect something in return." (Manager of the Learning Centre 1998)

The content provided was drawn from some of the best universities in the world as well as from custom-designed tools to help with employees' day-to-day duties. Content and direction were driven by the needs of Buckman employees:

> "The current goals include fully automated on-line administration of all training within the world-wide company, full language translation (into English, Spanish, Portuguese, French, and German), personalisation of curricula, skill set gap analysis, etc. As this is a new venture, we are still in the process of formulating many of our long-term goals." (Informant from the Learning Centre 1998)

The continuous strategic use of collective knowledge and the Learning Centre has certainly been a remarkable educational achievement. According to the Director of

the Centre, as a percentage of total personnel, the number of employees with a college degree increased from 39 per cent in 1980 to 73 per cent in 1997.

4.7.8 Slowness in Deploying a Systematic KM-focused HRM

Despite Buckman's concerted efforts to provide HRD activities on-line, the need for innovation in systematic KM-focused HRM – involving the design of new training programmes, performance evaluation and reward systems, and the introduction of knowledge leadership – soon become apparent. This was clearly evident in a comment made by one sales person in an internal survey:

> "The training has in the past been given by KTD, who do a good job at the 'this is how it works' approach. But we need to focus much more on what benefits can be obtained from sharing knowledge. One option might be to train a few sales people, let them be involved in documenting the benefits, using case history data in the training materials etc and selling the KM concept to the rest of the sales team, using KM department as training facilitators."

Part of the call for a systematic KM-focused HRM was the need for a reward and incentive system. Since 1992, Buckman Labs has occasionally introduced incentive programmes to build enthusiasm and momentum around the principles of KM. When KM was first introduced in 1992, as indicated earlier, there was some resistance towards the initiative. One of the possible reasons for this was the lack of employee motivation. The main source of the problem, as explained by one R&D

scientist, was the fear of job insecurity in relation to the sharing of personal knowledge:

> "Compensate the experts to give their knowledge to others. Where is the incentive for the experts to give their knowledge to others and then be replaced by computer data in the future! They are not going to participate and cut their own career."

To overcome this, a series of innovative approaches was used to encourage participation. An example was provided and explained by a former forum specialist: "there was a sense of resistance in the beginning, what we did was to mix a reward-and-punishment approach". Accordingly, a number of incentives were offered at the level of the individual, for instance:

> "Once in a while, we gave out monetary rewards ($50) for our Latin employees for their contributions in knowledge sharing. With the culture there, US dollars are always an incentive. Together with certificates, the monetary rewards were considered as successes, and it was later observed that participation in knowledge sharing there has gone up."

Although Buckman Labs does not offer regular financial rewards for posting knowledge, selective rewards have been utilised from time to time. For example, a one-time event at a fashionable resort which cost over $1 million was arranged for the 150 employees who had contributed the most widely used knowledge. At this

event, employees helped to shape the future of the KM initiatives. Those chosen received new laptop computers and participated in a number of KM-related discussions. However, this less than scientific approach to taking decisions met with some criticism:

> "There was a lot of resentment in the company about how people were chosen and what was going on. That lasted and is still present and so I think there's still a lot of resentment toward KTD just for that reason. You know, because everyone who was there got a brand new computer was rewarded and recognised. I think in some ways the resentment kept people from participating later." (Marketing manager)

Although some of those not included in the event felt disappointed and unhappy, the overall level of participation in the knowledge-sharing forums rose immediately. At the same time, the 'punishment' component became more subtle but even more persuasive. For example, during the early implementation period of K'Netix®, top management wrote to employees who did not participate in the sharing activities. The management asked why they did not wish to contribute, stressing that previous ways of working were becoming defunct and that change was necessary to secure the organisation's future success. Some of the reasons cited were related to being uncomfortable with technological changes and job insecurity issues. These concerns were taken aboard by the top management and played a big role in their subsequent development and implementation of KM-focused HRM.

While recognising the importance of having a systemic evaluation and rewards system and performance measurement system for knowledge sharing, Buckman did not begin to consider such needs seriously until 1997. The issue of knowledge worker performance measurement remains one of the most important yet least developed aspects of Buckman Labs' efforts to organise knowledge sharing. As one informant (sales personnel) explained:

> "We are just now (after seven years of implementing knowledge sharing) in a process of developing standardised job profiles for all of our employees which all contain a list of performance skills in addition to whatever other ones they need in their particular positions."

The slowness in developing a systematic KM-focused HRM was due to the fact that Buckman management initially felt that focusing too much on knowledge itself might actually hinder the normal process of knowledge dissemination, according to a VP-HR. In order to avoid that, "a valuable alternative implemented is the measurement and monitoring of both the process improvement and related outcomes". However, this proved to be insufficient as more and more employees were expecting clearer performance measurement details.

4.7.9 Knowledge Sharing Performance Evaluation

Initially, in terms of knowledge sharing performance evaluation, management's main concerns were raised over what should and could be measured, what particular contributions ought to be valued by the organisation, and what contributions individuals valued in relation to their participation in knowledge-sharing practices.

With the goal of developing a systematic KM-focused HRM, at the end of 1997 Buckman Labs teamed with LearnerFirst (a management consultancy company) to develop and implement an enterprise-wide human resource knowledge sharing system as part of its K'Netix® knowledge community. According to one forum specialist, the application was seeded by 'harvesting' the experience of Buckman Labs in knowledge sharing and the skills of three human resource experts to construct a set of Work Profiles (see Appendix 3) to be applied to all 1,300 employees world-wide. This measurement was designed to allow a knowledge base to be built which would make it possible to quickly map the company's intellectual competencies (through a knowledge audit) to facilitate rapid response to changing market and customer needs. The system also aimed to act as the foundation for employee performance reviews.

According to the VP-HR,

> "with the application (WorkProfile) in place, it facilitates a strong knowledge culture by providing a mechanism which easily conveys the knowledge of individual roles and competencies throughout the organisation. The application has also further enforced a strong sense of community in the organisation and a resulting agility in forming new teams."

Following the development of the application, it was Buckman management's intention to promote further cost saving by not requiring a large number of employees to manage the profiles. They accordingly appointed one individual to manage them technically while sharing the completion/evaluation aspects with each employee and their respective managers.

Finally, although still in its early stages, the adoption of work profiles has already helped Buckman management to better facilitate the evolution of knowledge communities. These in turn support organisational learning by fostering a common awareness of individual and organisational competencies. As explained by one forum specialist:

> "Employees wishing to access knowledge on a particular role in the organisation, to pattern their own development or to find co-workers to discuss a problem or opportunity, need only to access the relevant Work Profile(s)." (On-line discussion 1999)

4.8 Summary: The Emerging Issues

The preceding sections of this chapter have specified the wider historical context in which Buckman Labs has operated, and have examined the technical aspects of the organisation's knowledge transfer infrastructure, and its interactions between users and the chosen technologies. This section aims to identify some of the key problems relating to Buckman Labs' experience in organising the knowledge-sharing process from 1992 to 1998.

As indicated previously in this chapter, since 1992 Buckman Labs has pursued an institutionalised knowledge strategy for organisational transformation. The strategy has three objectives: to shift responsibility from the top of the organisation to teams; to encourage diversity and interaction across the traditional boundaries of organisation through the formation and emergence of communities of practice; and to stimulate the flow of information and knowledge within the context of a global KMS. As a result, a new socio-technical system for the organisation has evolved, based on CoPs rather than hierarchy. With these aims in view, the Buckman management decided very early in 1992 that they would need to adopt a strategic rather than reactive philosophy, and would need to focus on long-term infrastructure rather than short-term cost and inconvenience. This outlook is evident in their preference for calling their knowledge sharing practice an 'on-going journey' instead of a 'project'.

When Buckman Labs first embraced knowledge sharing, the top management knew that it would take more than sophisticated technology and leading edge software to ensure success. As the President of Buckman Labs' Knowledge Transfer Department put it, "No matter how technically advanced the information technology, it does not add any value if employees do not accept it and realise its importance in re-orientating their individual roles to those of knowledge workers". From the start, the challenge was to build a knowledge-intensive organisation involving changes at all levels and penetrating to the core of Buckman Labs' culture (Hoffman and Senge, 1993). Much of the value added by the technical changes associated with KM resulted not from the technology itself but from new arrangements and roles in the organisation. In other words, knowledge sharing was found embedded in the organisation's work processes. Thus, knowledge sharing could be facilitated by a combination of formal corporate Intranets and informal CoPs.

Another key lesson emerging from the case study is the need to position knowledge at the centre of ICT-strategy. The case reveals that since 1992 Buckman Labs has developed applications for business units and positioned ICT to support the real-time capture of the knowledge critical to maintaining the company's competitive advantage. Such knowledge underpins ICT strategy by enabling a flexible, robust infrastructure to support work processes or flow in knowledge-sharing activities. As the case study shows, the key technological challenge Buckman management faced was continuously to redesign the company's virtual processes in order to utilise

productively the most robust technologies that provide easier and faster electronic transfers of knowledge.

The advancement of new ICT has certainly been an important catalyst for the growing popularity of knowledge work at Buckman Labs. For example, the importance of knowledge exploration and exploitation was emphasised throughout the design and implementation processes. Instead of treating the system only as a repository for information, interactive discussions were also encouraged in order to gather the collective tacit knowledge of all employees. This represents a recognition that all knowledge is constructed in social contexts which are inseparable from shared understandings (Scarbrough, 1999). By facilitating a knowledge-sharing context, Buckman management has allowed knowledge to evolve through social interactions as well as through the formal KMS. In particular, CoPs (Brown and Duguid, 1991) have evolved informally involving the use of virtual communities to share information and build on others' knowledge in order to solve customers' problems.

4.9 Concluding Remarks

This chapter has presented the collected empirical data based on the on-going practice of knowledge sharing at Buckman Labs, a dispersed organisation that has successfully implemented an institutionalised global KMS since 1992. For the company, this has been a journey of chasing technology, knowledge sharing and

cultural change. The research began its inquiry into the dynamics of KM with the suggestion that the generation, processing, storage, dissemination and use or re-use of knowledge can be a potentially sustainable source of competitive advantage (Nonaka, 1994). In particular, the analysis has focused on the tensions and dilemmas facing managers in trying to tackle the problems of organising knowledge sharing in Buckman Labs. It has been shown that the company's fairly successful experience has not been without problems. Rather, there has been a combination of communication inertia, failure in providing common language within and among CoPs in the early stages, and slowness in deploying a systematic KM-focused HRM. Therefore, three key issues (the use of an ICT-based KMS, the facilitation of a knowledge-sharing context, and the development of a KM-focused HRM) form the basis for further discussion in Chapter 5.

5 Chapter Five: Interpretations and Discussions

5.1 Introduction

This chapter seeks to draw out the general lessons of the previous chapter's account of the processes and mechanisms of organising knowledge at Buckman Labs. These lessons may be divided into two broad categories. First, there are those relating to problems arising from the implementation of knowledge-sharing practice over time. Secondly, there are lessons concerning the socio-technical context required for effective knowledge sharing. In general, the analysis confirms the view that knowledge sharing is multifaceted, multi-layered and socially constructed (Blackler, 1995). This study shows that global knowledge-sharing initiatives within Buckman Labs facilitated a number of significant organisational changes over the period between 1992 and 1998. These changes evolved through a series of ongoing and interdependent technological and organisational adaptations that were planned as well as emergent.

The following sections aim to identify ICT-based knowledge systems, organisational processes and the strategic roles and factors involved from a socio-technical viewpoint. Some observations on the strategic processes of organising knowledge sharing are also offered. The case highlights the essential requirements of knowledge sharing as a strategic resource in organisational communities of

practice, and on the basis of these findings a socio-technical model of the organisation of knowledge sharing is subsequently proposed.

The chapter is divided into four sections. After the introduction, section 5.2 presents the socio-technical framework of organising knowledge sharing. Section 5.3, 5.4, and 5.5 focus on the three mechanisms (enabling, integrating and co-ordinating) identified from the case study. Section 5.6 summarises the findings.

5.2 The Socio-technical Framework of Organising Knowledge Sharing

This section theorises the empirical findings and relates them to three key areas: (1) the processes of organisational knowledge-sharing behaviour; (2) a postulated socio-technical framework to explore the organisation of knowledge sharing; and (3) the understanding of socio-technical integration from a managerial viewpoint.

The case described here underlines the diversity of knowledge-sharing issues involved in practice over time. They range from the adoption of an ICT-based KMS to the nurturing of communities of practice in which knowledge is created. Such issues also highlight the importance of the human resource management implications of the way in which knowledge is shared.

This case study shows that the different layers of knowledge sharing (technological, social and managerial) are as loosely coupled as the different sub-systems of the

organisation (Weick, 1979). Accordingly, the holistic socio-technical perspective is essential, since it captures the complex interactions that take place between the subjective perceptions of employees and the objective characteristics of work processes. Moreover, the development of a socio-technical approach towards knowledge sharing is concerned with the subtle and diffuse structuring of behaviour and perceptions arising from information flows and communication systems (Scarbrough, 1995). The identification of these different levels of the knowledge-sharing process is in itself a useful heuristic. It is not complete, however, without some recognition of the dynamic evolution of, and complex interaction between, the different levels. KMS do not develop spontaneously or in a vacuum; rather, they emerge out of the specific context and history of the organisation, and their impact is conditioned by the subjective perceptions of employees whose experience is governed by that history.

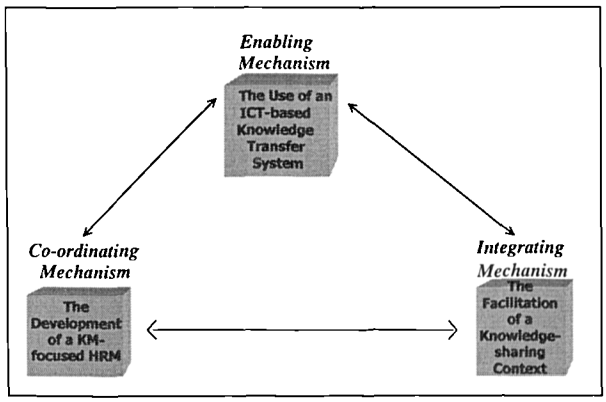

Figure 5-1: Organising Knowledge Sharing: A Socio-technical Framework

On the basis of the case study findings, a three-mechanism socio-technical framework is proposed (Figure 5-1) for the analysis of the organisation of knowledge sharing. The term 'mechanism' is used here to denote not formal structures or techniques but complex socio-technical processes. Three primary mechanisms -- enabling, integrating and co-ordinating – are identified (see Table 5-1 for details). In the Buckman Labs case these mechanisms denote (respectively) the use of an ICT-based KMS, the facilitation of a knowledge-sharing context, and the development of a KM-focused HRM. The research also suggests that these mechanisms apply to the organisation of knowledge sharing in communities of practice.

Organising Knowledge Sharing: A Socio-technical Framework
Enabling Mechanism: The Use of an ICT-based Knowledge Management Systems
1. ICT-based KMS and Knowledge Base
2. Universal Access
3. Virtual Community-based Organisational Structure
4. Open Internal Communication Structure
Integrating Mechanism: The Facilitation of a Knowledge-sharing Context
1. Knowledge-sharing Culture
2. Communities of Practice (Trust Environment and the Use of Common Language and

Metaphors)
3. Specialist Knowledge Processing Team
Co-ordinating Mechanism: The Development of a KM-focused HRM
1. The Role of Management
2. Training and Performance Evaluation
3. Rewards and Incentives
4. New Role for HRM

Table 5-1: The Mechanisms of a Socio-technical Framework of Organising Knowledge Sharing

5.3 The Enabling Mechanism: an ICT-based Knowledge Management Systems

Typically, when companies set out to initiate knowledge-related activities, the first issue that they tackle is that of technology. Buckman Labs is no exception. This section discusses the use of an ICT-based KMS for knowledge sharing. The intention is not to undertake an exhaustive review of the technology adopted, but to understand the systematic use of the KTS. In line with recent analyses (Orlikowski, 1996; Ciborra, 1996), the research emphasises the processual and emergent

qualities of the interplay between technology and organisation (Orlikowski, 1992). However, in contrast to other previous treatments of technology, this research considers the enabling role of ICT only as part of the facilitating elements in knowledge sharing. That is, it takes into account both ICT's enabling capability in providing efficiency and effectiveness in knowledge sharing and its socio-technical interactions in virtual communities of users.

The technology adopted in this study is considered as a new class of ICT known as co-ordinating technologies or groupware (Orlikowski, 1996). The use of groupware as a knowledge-sharing tool seems to represent a hybrid between technology and organisation (Latour, 1993; Coombs *et al.*, 1992). It unveils organisational processes of collective knowledge sharing and is intrinsically context-dependent. Groupware also defines a socio-technical system as it connects two distinct elements, organisational and technical (Ciborra, 1996). 'Group' suggests a collective way of operating and sharing. 'Ware', on the other hand, suggests the domain of tools and computer systems.

As far as the case study is concerned, the intention of using groupware was to provide support for co-ordination and collaboration through shared access to technological capabilities such as a knowledge base, discussion forums, and communication facilities. This is in contrast to the approach of most IT consultants, who consider information and communication tools as the 'answers' to improve the

KM of their organisations. Examples of such ICT-based tools include data warehouses, groupware systems such as Lotus Notes™ and the Internet.

Moreover, the nature of the relationship between the adopted groupware (an ICT-based KMS) and the organisation also stands out in the research findings. To determine the nature of the relationship, as Markus and Robey (1988) suggest, three perspectives are relevant: the technological, the organisational and the emergent. In this regard, most of the current literature on the issue of IT adopts a technological perspective (Zack and McKenney, 1995), arguing that some organisational changes are the direct results of implementing new technology. By contrast, the organisational imperative which assumes that people act rationally and purposefully to accomplish their objectives, while the emergent imperative views change as emerging from the interaction of individuals, events, technology and the organisation (Zack and McKenney, 1995).

In the case of Buckman Labs, the way ICT was utilised for organising knowledge sharing can be considered as the ermegent imperative view. In this case, ICT was useful not only in providing support to the nurturing process by increasing the ability to communicate across boundaries of time and space, but also helped to encourage knowledge sharing across different social groups and to reinforce social boundaries. On the other hand, applying ICT as a means of communication also highlights the more creative possibilities of KM, with multi-media applications

offering more user-friendly ways of sharing knowledge than the traditional paper-based system (Ives *et al.*, 1998). The ICT adopted in Buckman Labs was undoubtedly very valuable in facilitating communities of practice (CoPs). This conclusion supports the argument of McConnell (1994) that the potential of such networks (CoP) is to provide individual and organisational learning tools that help to build the 'informated organisation' (Zuboff, 1988), which is characterised by horizontal co-ordination, local control, mutual adjustment, critique and debate, and a self-organising capacity (Bannon and Schmidt, 1991).

5.3.1 ICT-based Knowledge Management Systems and the Knowledge Base

One major characteristic of the enabling mechanism is the need to establish ICT-based knowledge base for the organisation. As pointed out by Sivula *et al.* (1997), the knowledge base of a company can be studied from two perspectives: knowledge as a specific content resource and knowledge that serves as the foundation of the firm's ability to integrate the processes of knowledge creation and development. This study takes an integrated view of these two perspectives. In particular, it argues that knowledge is shared among organisational members and it is connected to the firm's history and experiences (von Krogh *et al.*, 1994). The ability to develop a knowledge base is increasingly seen as a fundamental process in competence building (Sivula *et al.*, 1997), since knowledge has come to replace other resources (Toffler, 1990).

Based on the findings, this study concludes that the ICT adopted by Buckman Labs played a big role in maintaining and developing the knowledge base. In particular, it had the most dramatic impacts on knowledge sharing through the use of groupware, the Internet and knowledge database/repositories. Also, the emergent nature of the relationship between the adopted ICT-based KTS and the organisation can be illustrated by the series of changes that have taken place, such as the abandonment of the regional forums, and the tensions between members of the CoPs over various issues of knowledge sharing. Thus, it can be concluded that Buckman Labs' ICT-based system was used to augment or 'informate' knowledge sharing rather than to automate it (Zuboff, 1988). On the other hand, despite the company's continuous reliance on technology, the adoption of the ICT-based KMS was no 'cure-all' solution to the complex problem of the global knowledge-sharing process. This became evident when, after the system was developed and implemented, a series of non-technical problems, dilemmas and tensions related to the change of organisational culture emerged.

This experience confirms the view that ICT is important but is not everything. There is, indeed, abundant evidence to show that the impact of an ICT-based KMS on the organisation often emerges over time unpredictably from complex social interactions between the ICT and organisational processes and actors (Markus and Robey, 1988). However, before turning to the real causes of problems, it is

important to identify some of the unique features of the ICT-based system adopted in the knowledge- sharing processes at Buckman Labs.

Buckman Labs' ICT-based KMS had two features that serve to distinguish it from other kinds of information systems such as LAN and E-mail systems. These features have far-reaching implications for the way in which the KTS was developed and used. The first feature was the enabling role played by the ICT-based KMS in organising knowledge sharing processes. In particular, it possesses the interactive capability to support communication, collaboration and the search for knowledge and information, rather than relying on static repositories of information and best practices. In technical terms, work tasks, team working, communication and learning operations were built on an infrastructure of information systems, communication applications (Intranet and groupware), and database access capabilities. Moreover, the adopted ICT was also considered by Buckman employees as a set of powerful tools for nourishing key knowledge, and has been used in many different forms. Specifically, according to some users, it had the capability to add new emergent technologies such as imaging, video conferencing and groupware to provide additional flexibility.

The second feature is related to the role played by the ICT-based KTS in developing the knowledge base. At Buckman Labs, the knowledge base is considered to be the foundation of organisational capabilities and competence. It

provided structures for 'repositories' (organisational forums and codified databases). Specifically, the knowledge base was also seen as the 'context' of the collective knowledge (explicit and tacit) which was created through social interactions and transferred via the use of ICT. In other words, ICT was seen as a collection of tools that could enable and extend knowledge-sharing activities. This highlights the feature of ICT as a highly accessible distributed technology with a multi-layered and multi-faceted capability, and the capacity to handle highly context-dependent patterns of usage with a multiplicity of functions.

It can thus be concluded that as an enabling mechanism, the ICT-based KTC provided the foundation for communication and knowledge-transfer activities across different CoPs. More specifically, the adopted ICT can be considered, in the words of Orlikowski (1992) and Weick (1990), as an 'open-ended' or 'equivocal' technology. This implies the ability to provide employees with universal access to an interactive medium as a distinctive feature which is critical for the successful organisation of knowledge sharing.

5.3.2 Universal Access

Another characteristic of the enabling mechanism is the capability to provide universal access to the ICT-based KTS. The findings of the case study suggest that the need to provide universal access arises from two main factors (Markus, 1990). First, Buckman management believed that only when everyone in the community

had access to an interactive medium would members be able to realise the full benefits of its use. This reflects the general rule that such benefits increase with the number of users and will be greatest when universal access has been achieved (Steinfeld, 1986). There was also an emphasis on reducing time and distance barriers and benefiting customers by providing 'real time' access to all Buckman employees, including technical specialists, regulatory affairs experts, research and development personnel, and others.

The second reason for allowing universal access is that, without a medium for universal access, CoPs risk disintegrating into non-interacting subgroups (Markus 1990). This was evident when increasingly fragmented and redundant knowledge-sharing efforts were seen to result from the failure to integrate the various regional forums.

On the other hand, however, as universal access requires universal participation among community members, it seems obvious that the likelihood of universal access will depend upon the magnitude of the resources participants are required to contribute (Markus 1990). The very same characteristics of interactive ICT-based KMS also made the above-mentioned conditions difficult to achieve. The resources required for universal access generally fall into two broad categories: equipment, comprising infrastructure and access devices (the specific technological configuration of the interactive medium used in a particular community); and effort, including knowledge and communication discipline (the mechanisms used within

the community to fund the acquisition and operation of equipment). In terms of the technological resources invested, this study shows that most employees were equipped with an IBM ThinkPad 720 with a modem. Employees could thus make a single phone call to establish point-to-point contact with headquarters and obtain the necessary access to global information and knowledge. In other words, the resources required for universal access were adequate.

Therefore, given a reliable ICT-based system available to Buckman employees for global knowledge sharing, efforts to facilitate knowledge sharing in CoPs becomes the primary issue in achieving universal access to the KTS. In this case, in terms of the factors that facilitated universal access, there is a need for CoPs that possessed the knowledge and skills necessary for operating access within the communities. As one informant put it, "we need to do a better job of hands-on learning and 'mentoring' in field applications. All the access in the world won't help if the representatives does not know what question to ask". In similar words, as Markus (1990: 206) put it, "it is not the costs of supplying infrastructure and access devices per se that affects the likelihood of achieving universal access, it is the extent to which these costs are borne by individual users". Since the resources allocated to the universal access of an ICT-based KTS were managed efficiently and effectively at Buckman Labs, the problems clearly resided elsewhere.

5.3.3 A Virtual Community-based Organisational Structure

In Buckman Labs the continuous journey of facilitating global knowledge sharing has not been without dilemmas and difficulties. As explained in Chapter 4, the impact of ICT has implications for both organisational structure and communication. The structural impact derives mainly from the emergence of looser and more spatially distributed organisational forms. The research shows that prior to the early 1990s Buckman Labs was a predominantly goal-oriented hierarchical organisation. However, this changed with the adoption of an ICT-based KMS in 1992. Although the traditional way of organising influenced Buckman management for a decade and created communication barriers to knowledge sharing, under the emerging community-based structure, the role of managers changed from that of traditional commanders to that of facilitators.

To begin with, the design of the knowledge-sharing forums has changed twice since 1992 (from single to multiple design and back to single again). Before the implementation of global knowledge sharing, most knowledge-sharing activities were conducted through the headquarters using traditional time-consuming and costly means, e.g. by fax and postal correspondence. The introduction of K'Netix in 1992 represented a major change for Buckman employees. For example, it modified the patterns of information and knowledge exchanges between headquarters and regional associate companies.

As already explained, in 1992 the global KTS was initially designed as a single (US-based) forum but was later expanded into multiple region forums. This initial shift was due to the communication barriers (stemming from differences of culture and language) faced by employees working in different parts of the world. The move to establish regional forums was first welcomed by many as a method of replacing the traditional image of a rigid centralised leadership style with a much more flexible, decentralised style of KM. However, within less than two years after the establishment of the last regional forum (the AAA forum), US employees from headquarters began to question the rationale for implementing a global KMS. In particular, the design of a regional form of knowledge sharing was considered by some, including the top management, as redundant and as responsible for creating divisions in a traditionally family-oriented organisational culture.

As a result of the change back to a single forum, a virtual community-based structure replaced the rigid, traditional and top-down organisational structure. In particular, CoPs evolved over time on the basis of an open internal communication system, although they did not appear on the organisation chart. To a large extent, the very nature of knowledge work gives ICT-based KMS an advantage over pyramidal forms of organisational design. For example, the new structure had several important features. First, it had both positive and negative impacts on the company's knowledge culture. This is because the new structure was constantly changing to reflect the new patterns, interrelationships and complexities of a rapidly

changing knowledge environment. Secondly, the network of CoPs, with its flatter structure, stimulates creativity and teamwork, and encourages an organisational cohesion that is open to sharing and working towards common goals.

5.3.4 Open Internal Communication Structure

Another key component of the enabling mechanism was an open internal communication structure that influences the knowledge-sharing capacity of a knowledge-based firm. In the initial stage (1993-95) Buckman Labs encountered some difficulty in handling global knowledge sharing. Any organisation that serves customers in a variety of geographical and cultural areas is likely to exhibit many of the typical structural barriers of a complex, hierarchical organisation.

Taking a more holistic view, the findings indicate that the open and emergent communication structure of Buckman Labs has provided an environment that is suitable for the fast changing business climate in which this knowledge-intensive organisation is operating (Cohen and Levinthal, 1990). Moreover, it is also evident that the changes made to the communication structure were due to the emergence of knowledge-sharing practices. These changes were not pre-planned but rather they emerged. This has clear implications for the way in which information and knowledge is accessed by organisational employees. In the past, access to information and knowledge were controlled by management. By introducing a new,

more open structure, Buckman employees were provided with almost unlimited real-time access to corporate data, information and expertise, thereby reducing their reliance on middle management and providing them with a sense of knowledge ownership. In other words, the availability of an open and emergent communication structure also implies a redefinition of the power relationships between management and employees. For example, the removal of the region-based communication structure in 1998 played a major role in empowering the organisation to take a further step towards a boundary-less, virtual community-based organisation. In this way, the nurturing of CoPs for knowledge sharing became an important managerial task that required an understanding of the interplay between technological, social and organisational elements. It is clear from this study that CoPs must be recognised as being quite different from traditional, functional project-based groups in organisations.

To conclude this section, it is clear that the knowledge-sharing process in Buckman Labs originally had a strong technical emphasis. This was largely due to the fact that the KTD was upgraded from the company's IT department. As a result, the early focus was mainly on the adoption of an ICT-based KMS and the communication and structural infrastructures within the organisation. Little effort was made to consider the social and managerial implications of knowledge sharing. This is not to suggest that technological issues were of secondary importance. Rather, what was required was an integration of the social, technical and

managerial elements of knowledge sharing. The absence of such integration was most clearly demonstrated in the first stage of the implementation of the knowledge-sharing initiative (1992-1995).

5.4 The Integrating Mechanism: The Creation of a Context for Knowledge Sharing

A core assumption in the literature on KM is that technology enables effective knowledge sharing. Thus there is an overwhelming emphasis on computer-related tools and information systems-driven approaches, and a relative neglect of social issues (Scarbrough *et al.*, 1999). In the case of Buckman Labs, computer networking technologies, including Intranet, groupware and databases, were often seen as providing the tools for the creation of 'knowledge bases', 'knowledge webs', and 'knowledge exchanges' (Bank, 1996). KM was frequently considered to involve mining for data. Indeed, metaphors such as mining, digging and drilling are frequently used in the existing literature (Leonard Barton, 1988; Finerty, 1997).

Moreover, it is evident in the literature review (chapter 2) that behind the strategic management perspective on KM lies a resource-based view of the firm which stresses the great importance of knowledge in relation to other forms of capital. Therefore, the key objective of organisations is to identify and capture the knowledge assets of the firm so that they can be fully exploited. With the concept of leveraging the knowledge assets in mind, the next logical move for organisations

is to create and develop tools for the activity. While knowledge assets have generally been considered only as 'resources', social issues are usually ignored. Accordingly, there have been few systematic efforts to understand the importance of people development, commitment, leadership and the locus of knowledge in which knowledge is created and shared. In other words, an understanding of community model of knowledge-related activities is missing from the existing literature (Scarbrough *et al.*, 1999).

Based on the support of the literature review and the empirical findings of this study, a need to understand knowledge and knowledge processes as embedded and constructed from and through social relationships and interactions was identified (Nonaka and Takeuchi, 1995; Blackler, 1995). As a result, this research endorses the view that "knowledge is not amenable to systematic codification and can only be accessed and transferred through intimate social interaction" (Kogut and Zander, 1992: 389). Since knowledge workers hold a reasonable amount of knowledge and understanding about a domain, which makes them valuable to certain types of organisations (Kock *et al*, 1996), shared knowledge in CoPs is thus utilised and transmitted through intensive and extensive interaction between group members. At the same time, both formal and informal groups may be created to discuss problems, develop new procedures, or codify current knowledge and skills (Stern, 1998).

As explained above, Buckman Labs' virtual community-based organisational structure played an integrating role in organising the knowledge-sharing process. It was not designed deliberately; instead, it evolved from the dynamic socio-technical environment in which knowledge sharing was practised. Therefore, CoPs at Buckman Labs can be seen to provide the work context of knowledge sharing. This is also the context that mirrors the intersection where organisation meets technology (Ciborra and Pattriota, 1996).

This reinforces the view that the effectiveness of organising global knowledge sharing is not limited to the issue of technological infrastructure. Rather, it is a question of conversational robustness – the ability of the KMS to provide a language structure and cognitive resources whereby people make sense of events within the network (Ciborra and Patriotta, 1996). Therefore, the research suggests that the integrating mechanism is primarily concerned with creating a context for knowledge sharing. More specifically, it consists of a number of processes, including the facilitating of a knowledge-sharing culture, the evolution of CoPs, and the establishment of a specialist knowledge processing team.

5.4.1 The Knowledge-sharing Culture

Having briefly identified the importance of creating an appropriate context for knowledge sharing, it is necessary to examine the culture that has helped to shape that context. The importance of a knowledge sharing culture is emphasised by

Nonaka and Tackeuchi (1995), who suggest that knowledge creation within an organisation is not simply a matter of processing objective information. Rather, it depends on tapping the tacit and often highly subjective insights, intuitions and hunches of individual employees and making those insights available for testing and use by the company as a whole.

At Buckman Labs, it was evident that knowledge sharing involved a strong internal focus, e.g. through the use of tacit knowledge. The Buckman management believed that tacit knowledge resided in the social interactions among employees. The organisation of a knowledge culture for the sharing of both explicit and tacit knowledge thus became the most important management task. However, culture is not simply a matter of conscious design by management; it reflects the evolution of the organisation over a period of time. For Buckman Labs, cultural change was emergent and had to overcome many obstacles related not only to technology but also to social and organisational factors. The process of cultural change was difficult, since Buckman management clearly recognised from the beginning that they were asking a great deal of their employees if they were to become active global participants. The company's approach was to think proactively by identifying the potential hurdles, removing or reducing their impact wherever possible, and, where feasible, putting in place appropriate social and technical support structures.

Failures in implementing KM systems are often blamed on the organisation's culture (McDermott, 1999). The case study shows that the development of knowledge sharing development has presented organisational cultural challenges to Buckman management. In particular, there has been a growing conflict between knowledge workers and management, which is the direct result of a clash of cultures (Raelin, 1992): "The inherent conflict between managers and professional results basically from a clash of cultures: the corporate culture, which captures the commitment of managers, and the professional culture which socialises professionals" (p. 1).

Buckman Labs' knowledge culture has a number of specific features. For instance, top management sought to move from a culture of knowledge hoarding to one of knowledge sharing by establishing norms of collaboration. Such hoarding behaviour is seen to be resulted from perceptions of the strategic value of information (Newman, 1997). In the case of Buckman Labs, as a result of early resistance to technological changes, the facilitation of a knowledge culture became a crucial element in the organisation of knowledge sharing. The knowledge culture at Buckman Labs can be viewed along three dimensions: 1) norms, beliefs and values ("the way we think around here"); 2) practices ("the way we do things around here"); and 3) rewards ("what receives recognition and benefits here"). At the same time, this kind of knowledge sharing culture can also be used to understand the habits, assumptions and actions behind some of the practices and

dilemmas found in the knowledge-sharing process. In particular, Buckman Labs' knowledge culture has influenced management behaviour in two areas: (1) knowledge architecture -- that is, the structure, mechanisms, and design of processes; and (2) knowledge dynamics -- that is, the rules, customs and ethics that guide action.

In addition, the move towards organisational de-layering, employee empowerment and the adoption of some elements of the flexible model of the firm requires a culture of continuous development and competence upgrading (Heraty and Morley, 1999). One very significant aspect of Buckman's culture consists of its knowledge-enterprising characteristics. For example, the most knowledgeable experts at all levels of the organisation are put in touch with one another, thus encouraging group problem-solving and the sharing of new ideas and knowledge. This knowledge-sharing culture has enabled Buckman personnel to collaborate closely with one another, unbounded by factors such as distance and time zones. It has encouraged open, unrestricted communication among experts and the free exchange of ideas. This knowledge culture has also helped to influence the 'absorptive capacity' (Cohen and Levinthal, 1990) of the organisation in the long run by providing a basis for developing a shared understanding of metaphors and language, as well as helping to shape the business processes which facilitate openness in communications. This knowledge culture is critical in helping Buckman Labs to

find innovative solutions to customer challenges, and to develop products in anticipation of future needs.

This study also confirms that culture is only one of the factors that determines organisational success in KM-related activities. There are two main reasons for this. First, any cultural change is difficult and in most cases takes longer than anticipated. Secondly, as more and more organisations are now operating in a cross-national and cross-cultural business environment, it takes a lot of effort to facilitate a cultural change, since the process is much more complex than ever before. Thus, more is required than simply introducing new ICTs to the organisation or strong management from the top. Rather, a common understanding and commitment among everyone in the organisation is essential.

5.4.2 Communities of Practice (A Trust Environment and the Use of Common Language and Metaphors)

While culture is a very important element of the integration mechanism for organising knowledge sharing at Buckman Labs, it is clear that culture alone is insufficient. Rather, the value and roles of communities of practice in the process must be considered. A knowledge-based organisation such as Buckman Labs needs to be seen as a set of CoPs. A CoP is here identified as a "living community which shares resources among its members and acts creatively to assure long-term survival" (Walck, 1996: 36). Much of the power of the CoP metaphor lies in its

ability to move beyond the traditional dichotomies that have often been accepted in the management field (Liedtka, 1999). Thus, it draws our attention to the fundamental role of values, context and meaning in the practice of knowledge sharing.

According to Swan (1999: 10), "knowledge cannot simply be processed; rather it is continuously re-created and re-constituted through dynamic, interactive and social networking activity". The concept of CoP highlights the importance of social relationships, shared understanding and attitudes to knowledge creation and sharing within organisations. As already explained in Chapter 2, most previous KM research (e.g. Nonaka, 1998; Brown and Duguid, 1991, 1998) has focused on knowledge communities or shared contexts. For example, in Brown and Duguid's (1991) view, an organisation can be usefully seen as a web of CoPs. The authors argue that the CoP is the main source of organisational learning and knowledge creation. For them, knowledge creation is also seen as a dynamic group process of seeking meaning and testing beliefs.

In the case of Buckman Labs, the phenomenon of CoPs was not entirely new. By 1985, virtual communities had grown up around various computer-mediated communications (CMC) such as bulletin boards. The widespread use of the Internet has already created on-line communities of sharing individuals, young and old, across cyberspace. What was new in the case of Buckman Labs was the use of

virtual communities to enhance information flow and knowledge transfer within an organisation. A virtual community can be used for strategic and tactical information if it is nurtured and organised by information providers who consider not only today's, but also tomorrow's, information needs (McDonell, 1995).

Two types of CoPs at Buckman Labs may be identified: task-oriented and social communities. First, the task-oriented communities (similar to the company's earlier KMS design) are small subgroups of employees who have mutual respect, share some common values, and generally get the important work done. They are not necessarily teams, task forces or any other authorised groups. With respect to interaction in the community, according to Markus (1990: 206), "informed dialogue among members is central to the on-going co-evolution of meaning and capabilities. Because the work itself is central to a view of business as a CoP, and because meaning, purpose, and learning is tied to the doing, everything of importance that happens is personal, and hence, local".

The other type of community – the 'social community' -- is just beginning to emerge in Buckman Labs. It is less visible and structure-less in nature than the ones of the traditional organisations. It is based on the concept of "network density, which is a more meaningful indicator of important variations in communication patterns than task interdependence" (Markus, 1990: 207). The case findings reveal that the bonding among participants in the communities is social as well as

technical, and is built around informed participation. Indeed, in this regard, sharing knowledge outside the community is extremely hard to enforce. Many Buckman managers have great difficulty in trying to understand and build any meaningful system around this process.

5.4.2.1 A Trust Environment

Buckman's experience demonstrates that an organisation's "ability to leverage knowledge typically involves finding, nurturing, and supporting the communities that already share knowledge about key topics" (McDermott, 1999). Buckman management recognised that knowledge has to be continuously negotiated through an interactive social networking process. Without the sense of personal trust, little knowledge changed hands, but once trust was established, knowledge moved in an informal way. The findings suggest that the process of nurturing of a trust environment is a crucial "lubricant" of the knowledge-sharing process (Scarbrough and Swan, 1999).

Buckman Labs' success in a fostering a trustful environment in the CoPs was based on a common understanding of the nature of knowledge. First, this was related to the recognition of the importance of tacit knowledge and the difficulties involved in trying to codify it. The Buckman management recognised early in the process that creating new knowledge involves not only objective, external information, but also tacit and highly subjective individual insights, intuitions and hunches. Secondly, the

notion that all workers are knowledge workers is an important factor. From Buckman management's perspective, the responsibility for creating and sharing knowledge resides not only in the R&D department but in the sociail interactions of CoP within the organisation. All employees are expected to be knowledge creators and sharers. Thirdly, the knowledge-enterprising culture at Buckman Labs has encouraged everyone to become knowledge entrepreneurs. This facilitative climate has encouraged employees to take risks, innovate and get out of the habit of asking for instructions. Knowledge entrepreneurship is rewarded, and inquiry and innovations are promoted within Buckman Labs. Some recent managerial promotions, for example, have been based on the managers' continuous active participation in knowledge-sharing practices.

5.4.2.2 The Use of Common Language and Metaphors

The use of common language and metaphors also plays a major part in facilitating a knowledge-sharing context, as knowledge circulates through CoPs in many ways (McDermott, 1999). Sometimes it is in the form of 'objects' such as work routines, tools, cabinets, products, the floor plan, stories, specialised language, and common wisdom about cause-effect relationships (Foucault, 1975). In particular, because of the very nature of CoPs, they need to be nurtured through the effective use of a common language and common metaphors. Since communication is essentially an exchange of information in words, ideas or emotions, true communication is only possible between people who share a system of meaning (Trompenaars, 1995).

Buckman management learned this lesson after going through a number of communicational difficulties and realising that language is a primary means through which organisational knowledge is socialised (von Krogh and Roos, 1995).

To share a common language in a CoP requires the creative use of metaphors and analogies (Nonaka, 1994). Buckman Labs' creative use of metaphors such as 'waterline' and 'town centre'was seen as the key to organising knowledge-sharing processes. This highlighted the aim of crossing the many barriers to communication that existed in the company. In this case, a common language and common metaphors were considered as the "glue" (another metaphor) that would bond members of a CoP together and provide the basis for the respect and trust that was necessary in a knowledge-sharing environment. This in turn encouraged the free exchange of ideas and opinions between employees, particularly when there was disagreement.

To sum up, the case findings conclude that "to leverage knowledge we need to focus on the community that owns it and people who use it, not the knowledge itself" (McDermott, 1999: 110). The trust environment at Buckman Labs is characterised by the way in which employees organise their own CoP activities. Ample resources were made available, such as an on-line learning centre and unrestricted connection time on the Internet. In other words, it was both structural and cultural factors, in combination, that nurtured a trust relationship within and

across CoPs. Moreover, although this study shows that CoPs evolve over a period of time, they are not in any sense "created" and cannot be managed. This observation lends supports to the notion that tacit knowledge cannot be codified. Rather, it can only be developed by organisation members through continuous informal learning processes that provide competence components as required through story-telling, dialogue, peer coaching, and shared communities of practice (Brown and Duguid, 1991; Nonaka and Takeuchi, 1995; Lave and Wenger, 1991).

5.4.3 The Specialist Knowledge-processing Team

The last component of the integrating mechanism is the specialist knowledge processing team. On its own, a CoP is incapable of developing the trust, commitment and open communication structure that helps the sharing process. In other words, it requires assistance in determining participants' needs in sharing, transferring and disseminating knowledge for the participants of the CoP. Therefore, a specialist knowledge-processing team is vitally important.

In the case study, many of Buckman Labs' knowledge-sharing activities required extensive and specialised expertise. Generally, knowledge-intensive activities such as knowledge processing and knowledge storage are complex and require experts who understand the nature of how KM works as well as the specific industrial subject matter. At Buckman Labs, this type of knowledge-processing work requires

technical professionals (section leaders) with proficiency in many areas to understand the functional requirements and the knowledge content that needs to be included in the processing stages.

Thus, a specialist knowledge processing team is critical to the organisation of the knowledge sharing process and plays an important role as an integration mechanism. Most importantly, the members of a specialist knowledge processing team must possess the social and technical skills needed to organise, analyse and verify the integrity of knowledge that has been fed into the system. The presence of specialist knowledge-processing team members – central figures in helping to nurture and implement the sharing process – may well be crucial for promoting and disseminating knowledge to the organisational memory. In other words, the team members can be seen to play a dual role (acting as a source of knowledge for problem solving as well as facilitating the knowledge sharing process) in building and fostering the knowledge sharing culture within the organisational boundary and across different CoPs.

Finally, ensuring that the specialist knowledge processing team works together can be a daunting task for management. It is vitally important to encourage cross-functional collaboration in the sharing process, and to ensure that members of the team keep up with the advancement of their industrial expertise.

5.5 The Co-ordinating Mechanism: The Development of a KM-focused HRM

In recent years, management researchers have suggested that the success of an organisation is becoming more dependent upon the management of organisational competencies (e.g. Prahalad and Hamel, 1990; Reich, 1991; Drucker, 1993). Therefore, it is reasonable to suggest that the roles played by managers as facilitators between knowledge workers and the top management are vital to the knowledge flow in organisations. In an interesting assessment of the existing KM literature in relation to people management, Scarbrough *et al.* (1999) consider KM to have provided important opportunities as well as tensions in increasing the scope and impact of HRM activities within organisations.

Moreover, as explained by Nahapiet and Ghoshal (1998), "the availability of electronic knowledge exchange does not automatically induce a willingness to share information and build new intellectual capital". In fact, many Buckman managers believe that organisations fail in their knowledge-sharing efforts because they get stuck in the encapsulation of the information stage or by rushing to ICT as the panacea. Rather, the managerial components of the process must be taken into account early in the process.

The review of the literature also shows that the focus of KM studies has moved from knowledge to the process of knowing activities taking place in virtual CoPs.

Taken together, all the above-mentioned reasons have triggered an interest in the managerial problems of knowledge-based intellect (Quinn, 1992) as a critical issue for many knowledge-intensive organisations. However, the details of a KM-focused HRM are rarely discussed in existing studies. This is perhaps due to the general lack of empirical studies of knowledge in organisations.

In view of the trends toward virtual community-based organisation and human-centred implementation of KM, HRM at Buckman Labs has moved increasingly towards playing a co-ordinating role in aligning knowledge activities behind common purposes, norms and values. Co-ordination, in this study, is found to have been achieved through mutual adaptation among members with common knowledge and shared implicit 'coding schemes' accumulated through interactions (Lam, 1997). Several factors are therefore highlighted in the following sections: the role of management; the provision of training and performance evaluation; the use of rewards and incentives, and the new role for HRM.

5.5.1 The Role of Management

As the above account has underlined, KM is a multi-level set of technologies, norms and practices. For such qualitatively different factors to evolve in a consistent, mutually reinforcing way, the guiding role of management is crucial. In this context, arguably, one of the most important items for the effective sharing of knowledge is a clear and conscious knowledge sharing behaviour. Within the

context of Buckman Labs' global KM system, employees were allowed and encouraged to speak freely about their opinions outside the chain of command. That is, managers were becoming the mentors of the organisation, which, at the same time, helped to eliminate the role of information gatekeeper. The traditional hierarchy was, on the other hand, beginning to collapse as knowledge was re-conceptualised as local.

One of the first key features of the enabling mechanism identified in the case study is the role played by managers in organising knowledge sharing. First, management's capability in reducing resistance to change is recognised as a critically important factor in determining the success or failure of n organisational initiative (Oakland and Sohal; 1987). Such resistance is often viewed by managers as the enemy of change (Schein, 1988). In the initial stage of cultural change at Buckman Labs in 1993, resistance occurred as a result of the introduction of a new technology as well as new philosophy. This may be seen as "an expression of reservation which normally arises as a response or reaction to change" (Block, 1988, p. 199). This expression is "normally witnessed by management as any employee's actions perceived as attempting to stop, delay, or alter change" (Bemmels and Reshef, 1991: 231).

One area where there was evidence of particularly poor communication during the development stage was in the lack of vertical communication between top and

middle management. This study indicates that the Buckman's top management had previously relied heavily on middle management layers to communicate decisions and instructions from the top to the bottom, and operational information from the bottom to the top (Li, 1997). In other words, before the introduction of knowledge-sharing practice, the requirements for knowledge sharing ran parallel to the norms of the corporate culture: people found ways to fortify their worth to the organisation through the control of scarce information.

The middle management's role in the knowledge-sharing process is also of key importance. In this case, Buckman's middle management did present some resistance to change in the initial stage of the process. This was because Buckman's top management had failed to communicate with them effectively. The company's experience highlights the importance of middle management involvement, as top management alone does not possess the vision and energy to stimulate and sustain effective knowledge-sharing practices. In other words, much of the tacit knowledge resides with the middle managers. As is evident in the case study, initially Buckman's middle management struggled to connect what they knew about the knowledge initiative to operational objectives and to understand how it (the implementation of knowledge initiative) might impact on their own positions. Of specific concern to them was the effect the knowledge initiative would have in the long term on their career opportunities. Later, the top management became aware of the resistance, they took actions to address it. In particular, instead of perceiving

resistance as the enemy of change, it was overcome by presenting the positive benefits of sharing knowledge. To do that, Buckman Labs' top management had to communicate and consults regularly with their employees over knowledge sharing issues. Middle management were also given the opportunity to be involved in all aspects of change initiatives and encouraged to participate in teamwork related to the process. Although the adjustment or "re-learning" process was difficult, the level of resistance to change was carefully monitored and eventually minimised by the top management, who set good examples and showed continuous patience.

In addition, the case study findings also point to the importance of top management explaining to the employees on the strategic value of what KM offers. For example, while Buckman Labs may have identified a clear need for corporate knowledge sharing and learning early in the process, it did not launch its initiative from the bottom up. Rather, the impetus was provided by the top management, in most cases the Chairman or CEO (Meister, 1998). In other words, it was evident that top management at Buckman Labs served as a role model for knowledge sharing. They contributed greatly to the creation of a corporate knowledge-enterprising culture, producing a managerial mindset that promoted internal co-operation and the efficient flow of information throughout the organisation worldwide. In particular, after the company's ICT-based KMS and tools were in place, Bob Buckman and other top HR executives began contributing regularly to forums and discussion

groups to demonstrate the management's commitment as well as to monitor the proceedings.

In Buckman Labs' experience, a knowledge-based organisation requires a shift from peer-to-peer competition to a more collaborative approach. In the process of transformation, strong leadership was the key to implementing guidelines for collecting and sharing information, thereby establishing collaboration as a new cultural norm. For example, as facilitators of the conflicts in the knowledge-sharing process, it was evident that Buckman managers also brought an understanding of the overall process, expertise in certain methods, and a limited understanding of the organisation. In particular, their duties included assisting in the selection of strategy and tactics so that the overall process unfolded appropriately; facilitating the use of specific methods and skills; and asking simple questions.

While the personal and hands-on efforts of top management played an important role in shaking the organisation out of its historical hierarchies, a shared, challenging, knowledge-sharing vision was also critical to the success of KM at Buckman Labs. As indicated in the case findings, a shared vision provided the management with the focus and energy for knowledge sharing. This shared vision has been found, since 1992, to have encouraged and energised employees to uncover the organisation's view of the future, and to have provided meanings and value for everyone. This shared vision also provided a context for selecting the

required type of ICT system and facilitating the knowledge-sharing culture. One indication of this is the extent to which a shared knowledge vision (characteristic of the KMS) provides clear implications for the type of KMS and other structural mechanisms required.

Buckman Labs' experience demonstrates that resistance remains to this day a complex, multi-faceted phenomenon that continues to affect the outcomes of change, both negatively and positively (Waddell and Sohal, 1998). As the case study has demonstrated, middle managers and top management both need to be involved in contributing to the creation of a corporate knowledge culture and a managerial mindset that promotes co-operation and the flow of knowledge throughout the organisation.

5.5.2 Training and Performance Measurement

Another requirement for the effective development of a KM-focused HRM is related to the training and performance evaluation of knowledge workers. Previously, organisations have considered training as an expense to be minimised. This is also the fundamental reason why organisations generally prefer to hire ready-trained workers rather than provide training themselves (Lynch, 1994; Stern and Ritzen, 1991). However, as the nature of work-related knowledge becomes more fluid, organisations have no choice but to take training needs more seriously. In order to become more efficient in providing training for employees, more and

more organisations are beginning to adopt the strategy of just-in-time learning via the Internet or Intranet (Stern, 1998).

With the trend towards providing flexible training using ICT, HR managers are likely to take on two additional training responsibilities in managing knowledge workers: to provide training in an on-line knowledge-intensive environment and provide KM-focused HRM activities. Brown (1984), for example, emphasises the key role of HR specialists in new interpretative communities through the provision of training experiences that can develop the ability to contribute to constructive knowledge sharing. This implies that training is to be provided on-line in and across CoPs. In other words, it suggests that knowledge should be acquired when and where it is needed. In this regard, in addition to the traditional distance learning concept, a number of emerging practices in promoting just–in-time learning are now being adopted by organisations, including: cross-training by co-workers, job rotation, suggestions systems, skill-based pay, and formal or informal groups (Stern, 1998). The last two practices are particularly important in the case of Buckman Labs' own experience in developing its on-line learning centre.

Another immediate implication for HRM is the adoption of KM-focused training and personnel development. In terms of knowledge-sharing training at Buckman Labs, HR personnel were left out of the decision–making and implementation process almost entirely, at least in the initial stage. Most KM-related training was

left to the KTD Department. Only recently (1998) did HR personnel begin to work with KTD personnel in developing training materials for knowledge sharing as well as for other job-related training. This involves allowing greater flexibility in employees' use of time so that they can adjust to the new technologies of KM tools. For example, employees are encouraged to learn how to use the ICT-based KMS, to understand the system's short-term and long-term benefits, and to review its effectiveness, e,g. in terms of facilitating knowledge sharing.

In fact, the lack of systematic evaluation and expectation of employees' participation in knowledge sharing is one important reason why Buckman Labs did not become a truly knowledge-intensive firm earlier. Among the obstacles to such an innovation, one key factor was the nature of a knowledge worker's job, which is extremely varied, complex and often highly individualistic. However, in due course, the company appreciated that, given its reliance on the contributions made by knowledge workers, meaningful performance measurement through qualitative practices was essential as a mechanism for motivating their work and facilitating knowledge sharing in the CoPs. The qualitative practices include a number of contributions to internal base practice databases, internal coaching and mentoring, effective team-working and team development, and product innovation. In this way, skill- and knowledge-based performance evaluation systems, which are a major departure from traditional HRM practices, have become the core of the performance evaluation system at Buckman Labs.

5.5.3 Rewards and Incentives

Any discussion of the issue of performance measurement inevitably requires an examination of the use of rewards and incentives. In general, the rise in the number and importance of knowledge workers is changing the balance of power within organisations and creating new tensions and responsibilities between management and knowledge workers. In this case, Buckman employees no longer work only for financial incentives and packages. Rather, the notion of incentive-based knowledge sharing has been implemented as part of the company's knowledge-sharing culture.

Since the beginning of the implementation, Buckman managers have been using "creative incentives" to encourage knowledge workers to participate in knowledge sharing (Matusik and Hill, 1998: 694). Usually these have been in the form of compensation and rewards and have been linked to the factors that help to improve the level of participation within the organisation. Use has also been made of one-time rewards. For example, in 1994, 150 Buckman employees were selected to participate in a meeting held at a holiday resort in USA, and they were all given new laptop computers to encourage their active participation in sharing knowledge. The use of creative rewards and incentives was arguably more a symbolic recognition – a 'culture-guiding device' – than a reward aimed at directly influencing behaviour (Scarbrough, 1999).

While the use of rewards was recognised as an effective management tool for the encouragement of key knowledge-sharing behaviours at Buckman Labs, it was also seen to be double-edged. This is because it generated resistance among some employees, particularly since it was linked to explicit sanctions for those who were less willing to co-operate. Despite the difficulties, however, the reward practice at Buckman Labs has succeeded in establishing the principle that employees should be rewarded according to their knowledge contribution as well as their formal job titles. This has undoubtedly provided concrete incentives for Buckman employees to share knowledge within the organisation. However, the use of rewards and incentives has been sporadic and ad hoc rather than systematic.

What this study suggests is that the use of incentives and rewards in organising knowledge sharing needs to be part of a comprehensive knowledge culture-building effort. It is extremely important to create a context in which knowledge sharing is encouraged or even demanded. There is therefore a need to foster a climate in which there is a powerful social obligation to share. Ultimately, it is HR's task to provide appropriate training, both technical and non-technical, for knowledge workers. It is clear from the case study that knowledge-based compensation and reward designs focused on challenges inherent in the nature of knowledge work while ensuring that monetary rewards and their administration never became an issue for knowledge workers. Thus, the new focus of compensation in organisations

needs to shift from old organising models to new ones that are tailored to the exigencies of knowledge work (Despres and Hiltrop, 1996).

5.5.4 A New Role for HRM

Finally, as far as developing a KM-focused HRM is concerned, there can be no doubt that the management of human resources and competencies is a crucial issue in organising knowledge sharing. Keegan (1998) used a detailed study of people management in a knowledge-intensive firm to demonstrate that traditional HRM practice prescription does not fit the needs of knowledge-intensive firms. The case study findings support Keegan's findings while adding that a KM-focused HRM is probably best developed after the initial stages of the knowledge-sharing system have been implemented.

In the case study, one of Buckman Labs' vital ingredients for the success of knowledge sharing was identified as its inter-relationship with HRM. Traditionally, the HR Department was responsible for training and education, career development and making available and developing appropriate human resources. With the growing emphasis on the importance of knowledge, the role of the department inevitably changed. For example, since 1996 the Bulab Learning Centre has been developed with an emphasis on allowing its employees to manage their personal and career development; and bringing new knowledge and skills to its employees in

a cost-effective manner. Such change implies a new role for HRM with major organisational implications for human resource managers (Despres and Hiltrop, 1996). In this case, the challenge facing HR managers is to facilitate a balance between the macro considerations, such as structural groups and cultural norms, and micro considerations, including a whole range of people practices and standards (Bahrami and Evans, 1997).

The present study provides important empirical evidence and lessons on how a KM-focused HRM was co-ordinated in an effort to organise knowledge sharing. First, the findings highlight the contribution of a specific human resource development interventions which help provide training and development initiatives for knowledge workers. As evidenced in the case study, HRD is being delivered in novel ways, for example through the development of the on-line Buckman Labs Learning Centre. HRD support of this kind is important not only in providing specific kinds of training and information, but also in promoting a common language and understanding amongst participants in CoPs (Scarbrough, 1999).

Secondly, the co-ordinating role of HR in facilitating knowledge sharing has also provided exciting opportunities for Buckman employees to nurture, shape and transform the CoPs with the assistance of the ICT-based KMS. With the new responsibilities of HR managers, a KM-focused HRM may be seen to have two major roles: one in dealing with traditional administrative transactions, and the

other in nurturing knowledge-related activities. Buckman's KM-focused HR teams have undertaken these roles by inserting influences without authority, building bridges, co-ordinating activities between information technologists and members of CoPs, and viewing themselves as catalysts.

Thirdly, the case findings also imply that HRM should move beyond a narrow focus on training to take a more central role in co-ordinating the context (social and technical) which facilitates knowledge sharing. Such a shift in perspective requires the ability to provide meaningful systematic measurement indicators and to contribute to constructive dialogue. In this regard, Buckman Labs' experience suggests that the measurement of the benefits and results of knowledge sharing alone was not the highest priority in organising knowledge sharing. It was more productive in the early stages to observe, monitor, nurture and celebrate early success than to work out elaborate knowledge-related measures.

Thus, the need for a KM-focused HRM is recognised not just as a simple implementation issue, but as an indication that a fuller understanding of the KM-focused HRM policies and system design is necessary. HRM is probably the least developed aspect of the KM practices at Buckman Labs. Although management believed that the early introduction of knowledge-sharing performance measurement would hinder development, since 1998 it has moved towards developing systematic measurement systems. Thus, as suggested in the case study,

the compensation package for knowledge workers is shifting from objective and rational, towards subjective, performance measures.

5.6 Conclusion

There are six particularly important lessons drawn from this study. First, it shows that organising knowledge sharing in CoPs is a more complex construction than narrowly rational IT or cognitive models would suggest (Alavi and Leidner, 1998; Skyrme and Amidon, 1997). While previous KM studies have focused either on the importance of social interaction or the adoption of ICT, this study concludes that organising knowledge sharing in a dispersed organisation actually requires an integration of three major mechanisms (processes): the use of an ICT-based KMS (the enabling mechanism), the facilitation of a knowledge-sharing context (the integrating mechanism), the development of a KM-focused HRM (the co-ordinating mechanism).

Secondly, the importance of the organisational and managerial capability in recognising the significance of socio-technical activities for the organisation of knowledge-sharing practice is also recognised. The focus of the analysis in this study has been on the interaction between technology and organisational actors (the need to facilitate cultural change to encourage knowledge sharing among employees world-wide) rather than on the characteristics of technology. The findings lead to the conclusion that there can be no doubt that this socio-technical

emphasis has contributed greatly to the relatively successful practice of KM at Buckman Labs since 1992. In other words, it can be said that no knowledge-sharing efforts will be effective, given today's globalised environment, without the enabling functionality of ICT. Such recognition also helps to identify that the 'softer' issue of cultural infrastructure needs to be addressed with the same urgency as the 'harder' issue of a technological infrastructure. This is an important lesson at a time when globalisation and rapid advances in technology are complicating matters for knowledge sharing by spreading operations and people across countries and cultures.

Thirdly, the notion that knowledge sharing is context-dependent, multi-layered, and is often developed through social interactions within CoPs is also demonstrated. In particular, the understanding of the nuances of community-based organisations and how they spread their strengths is important. Instead of proliferating knowledge-based networks which concern with the capture and distribution of information, organisations must now understand that organising knowledge sharing is as much a social activity as a technical one, and that computer networks that facilitate this kind of social interaction (dialogue) are likely to be more effective (Robertson, 1999).

Fourthly, the research finds that a knowledge-based organisation needs to possess the capability for dealing with environmental uncertainties, subjective human

communication processes and the context-dependent character of organisational change (Blackler, 1993). In particular, the interrelationships between ICT, social and managerial elements are demonstrated in the Buckman Labs case, since the use of knowledge transfer technologies enabled the decentralisation of the company's operations while maintaining centralised control, and provided a technological platform to implement global knowledge sharing.

Fifthly, the analysis has also shown that the integration of virtual autonomous groups in the work processes, with a ubiquitous electronic knowledge infrastructure, has enabled the optimum teaming of collective knowledge to create a sustainable competitive advantage for Buckman Labs. In other words, an ICT-based KMS, CoPs and a KM-focused HRM are considered as integrated structures that help to establish the context for the promotion of growth and continuous knowledge sharing, which is now the essence of competitive success and survival. These processes take on entirely new and different realities in integrated knowledge structures. What this study shows is that an organisation that frees its employees from the bondage of a traditional hierarchy and allows teamwork to develop within CoPs will be well equipped to gain and sustain its competitive advantage.

Finally, one of the most important findings from this case study was the effectiveness of the knowledge sharing process organised. This contradicts the simplistic prescriptions about KM which suggest that the implementation and

utilisation of a particular IS system are all that is necessary to facilitate effective knowledge sharing (Hislop, 1999). Instead, this case study shows that successful knowledge sharing is dependent not only on the use of particular technologies but also on the successful creation of a knowledge-sharing environment with a KM-focused HRM as the co-ordinator of related activities.

6 Chapter Six: Conclusions and Implications

6.1 Introduction

The findings presented in this dissertation address the conditions surrounding the implementation of knowledge sharing as an organisational practice. In particular, the case study focuses on the socio-technical processes and practices of the organisation of knowledge sharing over time. The driving force of this study was the literature review (Chapter 2) which revealed that some of the previous studies focus either on ICT or social interactions but fail to integrate the two dimensions.

The case study is based on detailed empirical evidence of the actual KM practice in a particular organisation (Buckman Labs) and its relation to the processes and practices of technological and social development. Although the selected case company is a fairly successful KM organisation, it should not be taken as an example of good practice. Rather, the research findings are intended to highlight the potential problems involved in organisational knowledge sharing.

The research has closely examined knowledge initiatives implemented during the period 1992-1998 by Buckman Labs, focusing on the organisation of knowledge-sharing processes. The research traces Buckman Labs' experience as a networked, global company organised as a set of linked knowledge-focused communities of practice. The data used in the case study are derived from a variety of sources and

help to create a retrospective picture of the company from 1992 to 1998. The richness of the data increases for the period from March to May 1998 since at this time the researcher conducted on-site interviews and observed meetings directly, thereby allowing a valuable opportunity to monitor events as they occurred.

Based on the findings of the case study of one distinctive knowledge-intensive organisation, the research presents a heuristic model of the organisation of knowledge sharing. It develops a socio-technical perspective on grounded field data and suggests that the experience of this organisation can be considered as a particular form of KM – one that utilises various mechanisms for leveraging knowledge sharing towards sustainable competitive advantage. While this study does not claim that knowledge sharing has an impact on organisational performance, or even that such a system can be replicated in other organisations, it does provide a basis for more comprehensively understanding knowledge-sharing processes as routes to sustainable competitive advantage (Watts *et al.*, 1997).

Theoretically, the case study provided the much needed empirical insights into the notion that implementation of KMS may require a change in organizational culture and that the values and culture of an organisation have a significant impact on the learning process and how effectively a company can adapt and change (Stata, 1989). In particular, this research demonstrates how a knowledge-intensive organisation has developed the systemic capability to leverage tacit knowledge

from ongoing practice and to share this knowledge within its organisational boundary. The findings provide a vocabulary that both practitioners and academics can use to identify similar components in other organisations so that future empirical work can be comparable and cumulative. Thus, the purpose of this chapter is two-fold: first, to bring together the main ideas emerging from this study; and secondly, to identify the practical and theoretical contributions and future implications of this dissertation.

6.2 The Key Research Issues

In proposing a theoretical framework of organising knowledge sharing, the framework is not based on a mere summary of the foregoing discussion. Rather, it provides at least a partial integration of the empirical and theoretical findings. Such integration is, in fact, a knowledge development process rather than a summary procedure, for it creates new understanding and new concepts by combining what has been discussed before.

The main conclusion of the research is that the organisation of knowledge sharing involves more than possessing the technological capabilities or skills to facilitate the social interactions in which most tacit knowledge is created and developed. In addition, it requires the social and technological capabilities to organise knowledge-sharing activities. In particular, the research identifies three mechanisms (the enabling mechanism, the integrating mechanism and the co-ordinating mechanism)

which are critical to the facilitation of the knowledge-sharing process in today's rapidly changing, globalised and socio-technical business environment. In order to contribute to the task of developing a socio-technical framework for the organisation of knowledge sharing, the following sub-sections present conclusions related to each of the research questions proposed in Chapter 1.

Research Question 1: What are the mechanisms involved in organising knowledge sharing activities over time?

The key mechanisms identified in the research are: the use of ICT-based KMS (the enabling mechanism); the facilitation of a knowledge sharing-context for integrating all organisational resources (the integrating mechanism); and the development of a KM-focused HRM for the co-ordination of all social activities (the co-ordinating mechanism). It is concluded that the analysis of these three mechanisms can provide a cornerstone for the further understanding of related knowledge-management practices.

First, the ICT-based KMS serve as an enabling mechanism to facilitate communication and knowledge-transfer activities across different CoPs. Although this study adopts an emergent approach towards the use of IT for knowledge sharing (Markus and Robey, 1988), this does not negate the contribution of information systems and information technologies. Rather, in line with previous

studies of knowledge-intensive organisations, the research suggests that there needs to be a reasonable emphasis on the use of computer-based systems, high-speed telecommunication, groupware, and global knowledge-sharing systems. Moreover, the delivery or transfer of knowledge is dependent on such systems acting as enablers of knowledge sharing. Notwithstanding its importance, ICT-based KMS does not in itself create knowledge, any more than a classroom does.

Secondly, in terms of the integration mechanism, the impacts of various organisational actions on the knowledge sharing process have been reviewed, and problems with the emergence of a knowledge culture have been analysed. The research findings show that it is important to recognise that knowledge is not just a matter of cognitive abilities and functional resources, but is embedded in and created from CoPs. There are two simultaneous approaches to creating a knowledge-enterprising culture. A 'bottom-up' approach creates a sense of community of practice and trust among people. A 'top-down' approach creates the norms, standards and overall value statements that are used by top management to drive strategies and behaviour.

In the case of Buckman Labs, knowledge sharing was facilitated and nurtured within and between CoPs. A shared understanding required the use of a common language and metaphors and was dependent on effective communication during collaborative activities, with teamwork constructing the collective vision which

guided the sharing activities. This interpretation stresses the emergent nature of a common group understanding and regards communication within CoPs as a central mechanism of knowledge sharing. Of equal importance is the acknowledgement and constructive use of the shared understanding and expertise which community members contribute to the social task of sharing (Cullen, 1999).

Thirdly, in terms of the co-ordination mechanism, this study concludes that knowledge-intensive organisations can be distinguished by their flatter organisation structures and decentralised decision-making processes compared with those of traditional hierachical organisations. This creates a range of new managerial challenges. At the core of managerial activities lies a particular knowledge sharing culture that concentrates specifically on intellect and reflection. Processes of KM are integrated into the fabric of the organisation, thus requiring a conceptual shift away from the traditional understanding of management roles.

Additionally, strong leadership was also identified as the key to implementing guidelines for collecting and sharing information, thereby establishing collaboration as a new cultural norm. In a nutshell, this study concludes that the 'softer' issue of a cultural infrastructure needs to be addressed with the same urgency as the 'harder' issue of a technological infrastructure.

Research Question 2: How are the mechanisms for organising knowledge sharing interrelated overtime?

In response to the second research question, this study concludes that one key function of organising knowledge sharing processes is its provision of broad, holistic overviews of knowledge-related issues and opportunities within the organisation. The task of organising intra-organisational knowledge sharing goes beyond the simple adoption of ICT. The transformation of organisational structures and processes in changing employees' behaviour and attitudes is equally important. The research finds that a technology-driven type of knowledge-sharing process is appropriate only for short-term, technology-led knowledge activities and can never lead to a virtual community-based knowledge-sharing organisation.

Moreover, this study concludes that knowledge sharing at Buckman Labs is not only a problem of how organisations can integrate and utilise their distinctive knowledge both effectively and synergistically (Nonaka, 1994), but is also about how firms organise knowledge sharing in CoPs. The findings suggest that knowledge-related activities develop through three distinct stages: a period of awakening or engagement with the need for change, followed by an energetic top-down process led by strong leadership, and then a difficult transition to engage in yet another transformation.

Such a perspective implies that while having the necessary competence is important for knowledge sharing, the need for an appropriate organisational climate and culture is equally critical (Leidner, 1999). The necessary conditions of a knowledge-sharing organisation are different from those for a traditional organisation. First, organisational climate and culture have to be fostered in order to necessitate the creation of more specialised knowledge processing. Secondly, they must facilitate an acceptance of cultural change. Thirdly, they blur the functional boundaries of organisational and communication structures. Finally, an awareness of the importance of knowledge from the management standpoint and its implications for the competitive advantage of the organisation is important, as is the possession of a strong human resource management focus for knowledge workers and the creation and nurturing of communities of practice.

To sum up, in this analysis, the organisation itself is re-conceptualised and perceived as a set of CoPs, with institutionalised dimensions that give these practices meaning, rather than as a system of tradable and transferable resources under the manipulation of management. Therefore, the resulting organisation for organising knowledge sharing is best described as a "dynamic, self-referring system only partially responsive to managerial influence" (Spender, 1996). The concept of organising knowledge sharing, with its emphasis on emancipatory and transformative imperatives at the individual, group, organisational and community levels, promotes a pro knowledge-sharing framework of management.

6.3 Theoretical Contributions

The sheer diversity of the issues raised in the case study, though it cautions against generalisation, also throws up important lessons about the manner in which knowledge sharing is organised and some of the limitations of existing approaches. As noted in chapter 2, one of the major weaknesses in current KM approaches is the tendency to focus too much on either technological or cognitive issues. The present study, by addressing the imbalance between the social and technical elements of KM analysis, seeks to make a novel and useful contribution to this area of research. In particular, this study offers two major theoretical contributions. First, it attempts to integrate the existing KM literature from various disciplines in order to demonstrate the need to understand the complex nature of KM-related issues. Secondly, it develops a socio-technical perspective on the organisation of knowledge sharing. This study also represents an attempt to answer previous calls to explore KM issues from a more holistic or pluralistic viewpoint (Tsoukas, 1993; Spender, 1996).

6.3.1 A Multiple Disciplinary Study of Organising Knowledge Sharing

The first major contribution of the research derives from the multi-disciplinary nature of this study. As the literature review of the KM literature has shown that, despite the burgeoning, prescriptive literature, the transition to this new organisational scenario is one that is under-researched because of poor

conceptualisation and a lack of systematic empirical evidence. By framing this research empirically, the present study makes several distinctive contributions to the literature.

The literature review has revealed a recent exponential growth of research interest in the area of organisational knowledge studies (Crossan and Guatto, 1996). This trend can be traced back to the time when management researchers first foresaw the emergence of knowledge organisations and their increasing importance in society (Drucker, 1988; Toffler, 1970). While the interest in KM continues, there is a widely acknowledged need for a more developed theoretical foundation for future empirical studies aimed at testing the existence and linkages of organisational knowledge and ICT used in the KM-related processes has been called for. Such dissatisfaction is partly due to the fact that much of the existing literature is concerned with the ontological debate about the nature of knowledge and therefore tends to promote particular approaches as a universal panacea (Pava, 1986). In particular, earlier treatments of KM typically viewed knowledge as a kind of economic asset or commodity, or as a purely cognitive phenomenon. In addition, there is also marked over-reliance on the role of information and communication technology and a lack of consideration of the socially constructed, self-reflexive process of organisational knowledge transformation (Nicolini and Meznar, 1995).

More specifically, by reviewing the existing literature in a multi-disciplinary manner, the research concludes that the literature suffers from the following limitations and inadequacies. First, research on organisational KM is hampered by a theory-driven approach involving a confusion of analytical levels and a lack of empirical case studies. In particular, the important issue of tacit knowledge sharing through the interplay of ICT and organisational context and process within CoPs is neglected. In contrast, by developing a socio-technical perspective on knowledge-sharing activities, the present study provides a possible analytical lens for future enquiries into knowledge-management activities. Moreover, while many of the discourses on organisational knowledge and other related concepts are abstract in nature, the research adds to the relatively small fraction of the literature that attempts to understand the structures and processes of the organisation of knowledge sharing through empirical investigation.

Secondly, while the strategic issues of organisational knowledge have increasingly attracted the attention of researchers, much of the existing KM literature still concerns itself with the ontological debate about the nature of knowledge. The present study deliberately seeks to avoid entering into this area of discussion. Rather, organisational knowledge is here understood, from a socio-technical perspective, as a subjective, local and pluralistic process (Tsoukas, 1996; Spender, 1996) as well as a functional resource by adopting a socio-technical perspective. The research also recognises the importance of understanding the tacit dimension of

knowledge and its embeddedness within social groupings. This view has also spurred the researcher to adopt a multi-disciplinary approach towards understanding the organisation of knowledge-sharing process.

Thirdly, while previous studies of knowledge-intensive firms have, in the main, failed to examine closely the use of ICT-based KMS as the enabling tool of knowledge-related activities, this research extends earlier work on KM (e.g. Nonaka and Tackeuchi, 1995; Leonard-Barton, 1992; Sveiby, 1997). For example, it focuses on a holistic view of the interplay between organisational context and the KM tools adopted by the organisation. In so doing, it brings together the previous discussions on technology (McLoughlin, 1999; Grint and Woolgar, 1997; Orlikowski, 1992) and the strategic issues of KM (Grant, 1996; Nonaka and Takeuchi, 1995). Based on the findings, it describes in theoretical terms how one organisation is developing the ICT-based systemic capability to effectively and efficiently to share tacit knowledge from ongoing practice and to create explicit organisational knowledge for future events. Thus, it provides a vocabulary that can be used by both practitioners and academics to identify similar constructs in other organisations so that future empirical work in the area can be comparable and cumulative.

Finally, by adopting a multi-disciplinary perspective on KM, the findings of this study reveal and addressing the imbalance between the supply-side (technology and

knowledge flows) and the demand-side (social and organisational factors) models of KM (Scarbrough *et al.*, 1999). While most research has focused on either one element or the other in the equation, the present study represents a fresh attempt to understand the complex, multi-layered, multi-dimensional and context-dependent concept with which many previous studies have struggled.

6.3.2 Towards A Socio-technical Framework of Organising Knowledge Sharing

The second major contribution of the research is the construction of a socio-technical model of organising knowledge sharing in a dispersed organisation. To begin with, this study has presented a preview of what future socio-technical studies are likely to look like. As pointed out by Mumford (1999), one of the challenges for future socio-technical students is to acquire the ability to apply socio-technical principles to the remote network of employees communicating electronically in the automated office of the future. This study has sought to achieve this objective by exploring the processes and mechanisms of how employees work via a remote network (ICT-based KMS). As a result, a number of new terms and issues have been identified as a basis for updating the socio-technical system theory (Pava, 1996).

Moreover, this study also concludes that it is possible to form autonomous groups that are physically distant from each other and communicate via terminals. In this case, virtual CoPs have been identified as emergent in nature, and it has been

shown that their knowledge-sharing context can only be facilitated and not managed. This study has demonstrated the difficulty involved in facilitating a shared context within and between CoPs. Despite the case findings, little is known about the details of how communities interact with each other.

On the other hand, in terms of Mumford's (1999) call for further efforts to apply socio-technical system theory to organisational phenomena, this study has demonstrated that socio-technical principles can be applied to large multinational establishments at the macro-social level. To explain further how socio-technical principles have helped explore the nature and processes of organising knowledge sharing, the following contributions are summarised.

First, the research concludes that a socio-technical perspective provides a basic language that can bring together the three orientations (social, technical and managerial) towards the organisation of knowledge sharing. The adoption of a socio-technical perspective has enabled us to examine the key resources used (including ICT) and to understand the social relationships constructed around knowledge sharing activities. Furthermore, it has allowed us to view knowledge-sharing activities as subject to social validation and review, instead of perceiving them as a means of accessing an objective reality (Scarbrough, 1996).

Secondly, the socio-technical approach facilitates the examination of the technological and organisational changes introduced by the adoption of ICT in knowledge sharing. In other words, it provides a binocular focus on social and technical sub-systems. This focus implies that the need for a delicate balance in the selection of new information technologies requires us take into account the existing social sub-systems and the need to change those sub-systems in order to accommodate the requirements of the new knowledge sharing process.

Thirdly, the adoption of a socio-technical perspective enables us to concentrate on the specific behavioural features of knowledge sharing within its socio-technical environment. In other words, it adopts an integrated approach which highlights the interweaving of social and technical factors in people's work behaviour. It also underlines the complex interactions which take place between the subjective perceptions of employees and the objective characteristics of work processes.

Finally, the socio-technical view provides us with a platform to recognise the social embeddeness of ICT-based KMS as an enactment of social reality (Weick, 1995). As a result, any self-evident account of the effects of the material aspects of technologies is rejected; instead it suggests that inhibiting or facilitating effects are a matter of interpretative action from people in their social context. In other words, this approach regards the social and technical dimensions as a 'seamless web' in

which there are no clear distinctions between the technical, social, economic and political elements of technological development (Bijker *et al.*, 1987).

In sum, this study enables us to view organisational knowledge-related activities as a) socially constructed, b) shaped by the emergent interplay between technological and organisational factors, and c) structured between tacit and explicit forms, and by the organisational context. This view, unlike most previous accounts of KM, proposes that knowledge-sharing activities can be more usefully seen as multi-layered systems with loosely coupled technological, social, and managerial elements interacting over time. This perspective on KM provides an important new outlook on the interplay between knowledge sharing and the organisational context, suggesting that much of the existing literature in this field is based on dubious functionalist and rationalist assumptions (Hislop *et al.*, 1998).

6.4 Methodological Implications

From a methodological point of view, this research is based on an empirical investigation of knowledge-sharing processes in Buckman Labs. The work can be characterised as a multi-method, in-depth field research study. Through a socio-technical perspective, this grounded approach case study traces the interplay between ICT and organisational context and processes through an analysis that encompasses the practices of knowledge sharing in a knowledge-intensive organisational context.

Methodologically speaking, the case findings prove to be useful in bridging the gap between the understandings of academics and practitioners with respect to the issues of organising knowledge sharing. In attempting to understand and explain knowledge sharing process, the research has undertaken an interpretative position using different sources of evidence to validate the results. In so doing, there are three distinctive features of the work's methodological approach.

First, in spite of the progress towards understanding KM initiatives, the practice of knowledge sharing is largely eclectic: managing organisational knowledge involves cross-functional work across cultural, technical and informational functional boundaries. The initial challenge for the researcher is to decide whether to adopt a single-discipline approach or to examine KM-related activities from a holistic viewpoint. It seems that the former is the more straightforward route academically; but the latter route, adopted in the research, is more likely to produce results that reflect the practicality of the KM issues.

Secondly, building on the practical concern of this research, there is the question of research access. As the distinctive phenomenon of true KM practice is rare and under-researched, any opportunity to negotiate access into pioneering knowledge-intensive organisations has to be dealt with carefully and creatively. This study provides an example of how a researcher can creatively negotiate access into such a pioneering company. For example, the researcher used e-mail as the tool for initial

contact in place of the traditional 'request letter' approach. This method suits the culture of a knowledge intensive firm and undoubtedly quickened the process of gaining access. In addition, during the negotiation process, the researcher also offered the outcome of the research to the company as a valuable means of documenting its evolution in KM initiatives. This particular access negotiation strategy could be of wider interest for future researchers intending to study knowledge-based organisations.

Thirdly, the research argues that the issue of flexibility in research design is the key to KM research. As clearly demonstrated in this research, feasible research questions need to be determined by access possibilities rather than by theoretical considerations. This study has adopted a combination of flexible and iterative approaches to research design in an attempt to allow learning to take place throughout the fieldwork period. As such, a synthesis of methods, including ethnography, case study and grounded theory, was found to be useful in investigating a complex phenomenon such as KM.

6.5 Managerial Implications

A socio-technical perspective on the organisation of knowledge sharing has far-reaching implications for overall management practices. In particular, we suggest four practical guidelines that can be drawn from this research.

6.5.1 Managing Cultural Change

Building a knowledge intensive organisation is not an individual task. It demands a shift that goes all the way to the core of organisation's culture (Hoffman and Senge, 1993). When organisations start their journeys towards becoming knowledge-intensive, the challenge is not simply one of technology. The case study illustrates that much of the value added by the technical changes associated with KM results not from the technology itself but from the new arrangements and roles within the organisation between management and the people who can make the best use of the technology. It is clear that the organisation of knowledge sharing must be embedded in the processes in which people work. This case demonstrates how knowledge sharing is facilitated through formal corporate Intranets and informal communities of practice. In the case of Buckman Labs, the organisation of knowledge-sharing practices was found to be incorporated in the company's culture to ensure that it achieves its mission to compete strategically on knowledge.

6.5.2 The Need to Create and Maintain a Knowledge-sharing Culture

This study also suggests that however successfully an organisation transforms its environment for KM in the short term, a more daunting task is to facilitate a truly knowledge-entrepreneurial culture in the long term. More specifically, the task is to continuously create and maintain a knowledge-enterprising culture and community in which associates feel comfortable with knowledge and are motivated, rewarded

and entrepreneurial. Equally challenging is the task of developing a knowledge-focused reward system that can effectively replace the traditional, commission-based reward mechanisms.

6.5.3 An ICT-based Knowledge Management Systems is Only an Enabling Mechanism

In addressing the issue of ICT-based knowledge architecture, this research shows that the KMS, as an enabling mechanism, includes more than ICT platforms and other hardware and software applications. This view implies that knowledge strategy is critical and so are the underlying paradigms that drive the stages of planning, design and implementation, along with the roles of employees throughout the organisation. This perspective leads to the conclusion that the notion of an ICT-based system as an enabling mechanism is fundamental to the development of knowledge delivery, collaboration and sharing in an organisation. As such, this notion implies the flattening of the formal organisation and the communication hierarchy, and the universal availability of information and knowledge critical to the efficient achievement of knowledge sharing. This study of an integrated knowledge architecture expresses a holistic perception of what architecture means in practice. While many organisations view knowledge sharing as an extension of information management, this involves a risk that the knowledge sharing effort will be focused narrowly on technology and information availability. Rather, the emphasis should be placed on innovation and collaborative creativity. No matter

how technically advanced the information technology, it does not add any value if employees do not accept it and realise its importance in re-orientating their individual roles to those of knowledge workers.

6.5.4 Managing Knowledge Workers

In the process of organising knowledge sharing, organisations have to manage their knowledge workers in ways that are different from traditional managerial approaches. The effectiveness and value of KM depends on the active participation of individual knowledge workers. Having systems and tools available is important but insufficient. This study suggests that constantly evolving HRM practices can be carefully applied to secure an equal emphasis on technology, structure and knowledge-enterprising cultural factors, thereby assisting management to identify the facilitating and inhibiting factors that will ultimately determine the success of global KM.

In summary, this study has investigated the effects of fostering a knowledge-sharing context within a particular organisation. It concludes that such a KMS involves more than new computerised technology; it also involves a new knowledge-enterprising culture in which new roles and constructs are created. At Buckman Labs this innovation changed the communication patterns between individuals and teams, and also changed the design of the organisation by fostering new processes and structures. Learning and competence development was

encouraged, and a KMS was instituted to foster the integration of knowledge sharing and to sustain a competitive advantage for the organisation. While no other organisation has a KM system similar in its entirety to that of Buckman Labs, many organisations set up mechanisms and management processes to achieve portions of it. Much work remains to be done, but this study lays the groundwork for further research on the characteristics and effects of knowledge sharing.

6.6 Research Limitations and Future Directions

This dissertation ends with some critical observations regarding the limitations of the present research on the organisation of knowledge sharing and makes some suggestions for further research in the future.

This study has several limitations that can be viewed as opportunities for further research. First, given the formative nature of research in this area and in order to preserve individual experiences concerning knowledge-sharing practice, this study was limited to a single case study. As a result, the findings may have very limited general applicability. Future research may attempt to replicate this study under different organisational settings and with different ICT in order to extend the external validity of the findings. Rather than presuming that there is only one form of organisational structure or culture appropriate for knowledge sharing, we need to understand the relativity of these organisational characteristics and the relationship between knowledge-sharing orientations and other organisational processes

(DiBella *et al.*, 1996). We also need to understand the connections between an organisation's knowledge-sharing orientation, its product or service, and its industrial environment. More future research in these areas would contribute to the development of a pluralistic, rather than normative, view of organisational knowledge-sharing capability.

The understanding of an organisation's knowledge-sharing orientation and mechanisms provides a basis for designing change plans to increase knowledge-sharing capability. Organisations can choose to change their orientations or enhance those factors that facilitate knowledge sharing. Having outlined key mechanisms and processes for organising knowledge-sharing activities, it is important to analyse the organisational knowledge-sharing capabilities in more detail in the future.

Specifically, much of the existing research focuses on the either on the social or technological aspects of knowledge sharing processes. Research is now needed that moves beyond the source and state to consider the conditions that facilitate knowledge sharing across different social-technological levels. Descriptive studies have identified culture both as a major hindrance and enabler to knowledge sharing. Future research can examine the relationships between various organizational cultures and knowledge sharing. For example, do certain organizational cultures foster knowledge sharing? If so, must cultural change occur before knowledge

management initiatives can be successfully undertaken or can knowledge management initiatives facilitate cultural change?

As a second limitation, this study was mostly restricted to the study of U.S. employees based in Tennessee enacting major KM initiatives. In particular, little detailed observation was made of field-based sales/technical employees. As such, few conclusions are drawn on the extent of actual knowledge initiatives validated in the business. Therefore, future research in these areas would contribute to developing a more pluralistic view of an organisation's knowledge-sharing capabilities. In particular, the understanding of an organisation's knowledge-sharing orientations could also provide a foundation for designing change plans to increase knowledge-sharing capabilities. Therefore, organisations can choose to change their orientations and address factors that facilitate knowledge sharing.

Thirdly, there is also a need to explore issues and concerns further regarding the use of an ICT-based knowledge sharing system. The research suggests that technology plays a crucial transformational role and is a key part of establishing a knowledge-sharing culture. In many ways it is technology that has made the organisation of global knowledge sharing a reality. Therefore, one cannot discount the importance of information technology access and utilisation for the knowledge workers who participate in knowledge-related activities within organisational boundaries and are also impacted by such processes. However, two issues are important for future

studies of ICT-based KMS. First, there is a need to base such studies on an integrated understanding of the technological design and performance of IT systems. Specifically, future research can focus on whether an increase in the breadth, depth, quality, and timeliness of organizational knowledge result in improved decision making, reduced product cycles, greater productivity, or better customer service. Secondly, users of the system need to have an integrated understanding of the importance of KM and social interactions. For example, issues of trust can be furthered developed and studied. What level of trust do individuals have in knowledge that resides in a system but the originator of whom they do not personally know? Does trust, or the lack thereof, inhibit individuals' use of knowledge stored in a KMS?

Fourthly, the next phase of research into the organisation of knowledge sharing requires the further development and operationalisation of concepts, the development of standardised measures, and the formulation and testing of specific hypotheses. The critical requirement for effective knowledge sharing is the integration and functioning of the social and technological sub-systems of the organisation. A socio-technical perspective could provide a rich set of concepts, processes and structural configurations, and a powerful framework for in-depth future investigation.

Finally, future research must give more attention to the impact of CoPs on the organisation of knowledge sharing. Such CoP develop a shared understanding or a "collective knowledge base" (Brown and Duguid, 1998) from which knowledge emerges. One research question is thus: is the usefulness of knowledge related to the extent context is shared among members? How does changing organizational subunit membership (i.e., turnover) affect knowledge sharing and other knowledge-related activities? To answer these questions, several methodologies can be applied, e.g. statistical investigations, hypothesis testing, longitudinal studies, and comparative studies. By using interdisciplinary approaches simultaneously, future studies can provide more evidence to explain the elements that constitute a pattern that hinders and facilitates knowledge sharing in the organisation. Based upon the arguments and findings in this research, we have proposed a socio-technical theory of organisational knowledge sharing in a dispersed organisation. As a last word, the above-mentioned discussion points to key areas in which further research is needed. In this study, an attempt was made to enhance our understanding of knowledge sharing and to provide both researchers and managers with an instrument to structure their ongoing research and discussions regarding these issues.

References

Alvesson, M. (1993). "Organizations as Rhetoric: Knowledge Intensive Firms and the Struggle With Ambiguity", *Journal of Management Studies*, November, 30(6): 997-1015.

Alavi, M. and D. Leidner. (1998). "Knowledge management systems: emerging views and practices from the field". Working paper, University of Maryland.

Amit, R., and P. Schoemaker (1993). "Strategic Assets and Organizational Rent", *Strategic Management Journal*, (14): 33-46.

Anderson, J. C., and J. A. Narus (1990). "A Model of Distributor Firm and Manufacturer Firm Working Partnerships", *Journal of Marketing*, (January). 54(1): 42-59.

APQC International Benchmarking Clearinghouse. (1997). *Using Information Technology to Support Knowledge Management*. Houston, Texas.

Argyris, C. (1989). "Strategy Implementation: An Experience in Learning", *Organization Dynamics*, (Autumn): 1-5.

Argyris, C. and D. Schön. (1978). *Organizational Learning*. Addison-Wesley, Reading, MA.

Arthur, W. B. (1990). "Positive Feedback in the Economy", *Scientific American*, (February): 92-99.

Bahrami, H., and S. Evans. (1997). "Human Resource Leadership in Knowledge-Based Entities: Shaping the Context of Work", *Human Resource Management*, Spring, 36(1): 23-28.

Bailey, C. A. (1996). *A Guide to Field Research*. Pine Forge Press, Thousand Oaks, CA.

Balasubramanian, V. (1995). "*Organizational Learning and Information Systems*", Working Paper: Graduate School of Management Rutgers University, Newwark.

Bannon, L. J., and K. Schmidt. (1991). "CSCW: Four Characters in Search of a Context", in *Studies in Computer Supported Cooperative Work*. J. M. Bowers and S. D. Benford (eds), Elservier Science Publishers, North Holland.

Barker, R., and M. Camarata. (1998)."The Role of Communication in Creating and Maintaining a Learning Organization: Preconditions, Indicators, and Disciplines", *The Journal of Business Communication*, 35(3): 443-67.

Barley, S. R. (1986). "Technology As an Occasion for Structuring: Evidence From Observation of CT Scanners and the Social Order of Radiology Departments", *Administrative Science Quarterly*, (31): 78-108.

---. (1990). "The Alignment of Technology Departments", *Administrative Science Quarterly*, 35(1): 61-103.

Barney, J. B. (1991). "Firm Resources and Sustained Competitive Advantage", *Journal of Management*, (17): 99-120.

Bartlett, D., and S. Payne, (1997). "Grounded Theory- Its Basis, Rationale and Procedures", in *Understanding Social Research Perspectives on Methodology and Practice*. G. Powell J. McKenzie and R. Usher (eds). Falmer Press, London.

Baumard, P. (1996). "Organizations in the Fog: An Investigation into the Dynamics of Knowledge", in *Organizational Learning and Competitive Advantage*. B. Moingeon and A. Edmondson (eds), 74-91. Sage Publishers,

London.

Becker, H. S. (1970). *Sociological Work: Method and Substance.* Aldine, Chicago.

Bell, D. (1973). *The Coming of a Post-Industrial Society: A Venture in Social Forecasting*. Basic Books, New York, NY.

---. (1980). "The Social Framework of the Information Society", in *The Microelectronics Revolution*. T. Forester (eds), 500-49. Blackwell, Oxford.

Bemmels, B., and Y. Reshef. (1991). "Manufacturing Employees and Technological Change", *Journal of Labour Research*, Summer, 12(3): 231-46.

Benbasat, *et al.* (1987). "The Case Research Strategy in Studies of Information Systems", *Management Information Systems Quarterly*, 11(3): 368-86.

Bennett, R. (1998). "The Importance of Tacit Knowledge in Strategic Deliberations and Decisions", *Management Decision*, 36(9): 589-97.

Berger, P., and T. Luckmann. (1966). *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Penguin Press, Allen Lane.

Bijker *et al.* (1987). *The Social Construction of Technological Systems: New Directions in the Sociology of History and Technology*. MIT Press, Cambridge, MA.

Blackler, F. (1993). "Knowledge and the Theory of Organizations: Organizations as Activity Systems and the Reframing of Management", *Journal of Management Studies*, 30(6): 862-84.

---. (1995). "Knowledge, Knowledge Work and Organizations: An

Overview and Interpretation", *Organization Studies*, 16(6): 1021-46.

Blau *et al.* "Technology and Organization in Manufacturing." *Administrative Science Quarterly*, 21 (1976): 20-40.

Block, P. (1989). "Flawless Consulting", in *Managing Organisational Change*. R. McLennan (eds). Prentice Hall, Englewood Cliffs, NJ.

Bohn, R. (1994). "Measuring and Managing Technological Knowledge", *Sloan Management Review*, (Fall): 61-73.

Boisot, M. (1987). *Information and Organizations*. Fontana, London.

Boland, R. (1985). "Phenomenology: A Preferred Approach to Research in Information Systems", in *Research Methods in Information Systems*. R. A. Hirschheim G. Fitzgerald and A. T. Wood-Harper E. Mumford (eds). 193-201. North-Holland, Amsterdam.

Boland, R., and R. Tenkasi. (1995). "Perspective Making and Perspective Taking in Communities of Knowing", *Organization Science*, 6(4): 350-72.

Bouchard, T. J. Jr. (1976). "Field Research Methods: Interviewing Questionnaires, Participant Observation, Systematic Observation, Unobtrusive Measures", *Handbook of Industrial and Organizational Psychology*. M. D. Dunnette (eds). 363-413. Rand McNally, Chicago, IL.

Boyatzis, R. E. (1982). *The Competent Manager: A Model for Effective Performance*. Wiley, New York.

Bradach, J. L., and R. G. Eccles. (1989). "Price, Authority, and Trust: From Ideal Types to Plural Forms", *Annual Review of Sociology*, (15): 97-118.

Bresnen, M. (1988). "Insights on Site: Research into Construction Project Organizations", in *Doing Research in Organizations*. A. Bryman (eds). 34-52. Routledge, London.

Brown, G. (1984). "Accounts, Meaning and Causality" in *Accounts and Actions*. G. Gilbert and P. Abell (eds). Gower, Aldershot.

Brown, J., and P. Deguid. (1991). "Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation." *Organizational Science*, February, 2(1): 40-57.

Brown, J. S., and P. Duguid. (1998). "Organizing Knowledge", *California Management Review,* Spring. 40(3): 90-106.

Bryman, A. (1984). "The Debate about Quantitative and Qualitative Research: a Question of Method or Epistemology?" *British Journal of Sociology*, (35): 75-92.

Bryman, A. *et al.*, (1988). eds. *Doing Research in Organizations*. Routledge, London.

Buchanan, D. *et al.* (1988). "Getting in, Getting on, Getting Out, and Getting Back", in *Doing Research in Organizations*. in A. Bryman (eds). Routledge, London.

Buckman, R. (1998). "Knowledge Sharing at Buckman Labs", *Journal of Business Strategy*, (January/February): 11-15.

Burgelman, R. (1983). "A Process Model of Internal Corporate Venturing in a Major Diversified Firm", *Administrative Science Quarterly*, (28): 223-44.

Burgess, R. (1993). *Research Methods*. Thomas Nelson and Sons Ltd,

UK.

Burrell, W. G., and G. Morgan. (1979). *Sociological Paradigms and Organizational Analysis*. Heinemann, London.

Cavaye, A. L. (1996). "Case Study Research: a Multi-Faceted Research Approach for IS", *Information Systems Journal*, (6): 227-42.

Chakravarthy, B. S., and Y. Doz. (1992). "Strategy Process Research: Focusing on Corporate Self-Renewal." *Strategic Management Journal*, (13): 5-14.

Ciborra, C. (1996). "Introduction: What Does Groupware Mean for the Organizations Hosting It?", in *Groupware and Teamwork: Invisible Aid or Technical Hindrance*. C. Ciborra (eds). 1-22. John Wiley & Sons, Chichester, UK.

Ciborra, C., and G. Patriotta. (1996). "Groupware and Teamwork in New Product Development: The Case of a Consumer Goods Multinational", in *Groupware and Teamwork*. C. Ciborra (eds), John Wiley & Sons, Chichester UK.

Cohen, D. (1998). "Toward a Knowledge Context: Report On the First Annual U.C. Berkeley Forum on Knowledge And The Firm", *California Management Review*, Spring. 40(3): 22-39.

Cohen, W., and D. Levinthal. (1990). "Absorptive Capacity: A New Perspective on Learning and Innovation", *Administrative Science Quarterly*, March. 35(1): 128-52.

Constant, E. II. (1987). "The Social Locus of Technological Practice: Community, System or Organization", in *The Social Construction of Technological Systems: New Directions in the Sociology of History and Technology*. Bijker, *et al.* MIT Press, Cambridge.

Coombs, R. D. Knights H. Willmott. (1992). "Culture, Control and

Competition: Towards a Conceptual Framework for the Study of Information Technology in Organizations", *Organization Studies*, 13(1): 51-72.

Craig-Smith, N. (1989). "The Case Study: A Vital Yet Misunderstood Method for Management", in *Frontiers of Management*. R. Mansfield (eds). Routledge and Kegan Paul, London.

Creswell, J. (1998). *Qualitative Inquiry and Design: Choosing Among Five Traditions*. Sage, Thousand Oaks, London.

Crossan, M., and T. Guatto. (1996). "Organizational Learning Research Profile" *Journal Of Organizational Change Management*, 9(1).

Cullen, J. (1999). "Socially Constructed Learning: a Commentary on the Concept of the Learning Organisation", *The Learning Organization* 6(1): 45-52.

Dabbs, J. Jr. (1982). "Making Things Visible", in *Varieties of Qualitative Research*. Van Maanen (eds). Sage, Beverly Hills, California.

Daft, R., and K. Weick. (1984). "Towards a Model of Organizations as Interpretation Systems", *Academy of Management Review*, 9(2): 284-95.

Darke *et al.* (1998). "Successfully Completing Case Study Research: combining Rigour, Relevance and Pragmatism", *Information Systems Journal*, (8): 273-89.

Davenport, T. (1995). "Knowledge Management at Hewlett-Packard, Early 1996", *Center For Business Innovation*. 1-4.

Davenport, T. Jarvenpaa S., and M. Beers. (1996). "Improving Knowledge Work Processes", *Sloan Management Review*, (Summer): 53-65.

Denzin, N. K. (1978). *The Research Act: A Theoretical Introduction to*

Sociological Methods. McGraw-Hill, New York.

---. (1989). *Interpretive Biography*. Sage, Newbury Park, CA.

Despres, C., and J-M. Hiltrop. (1996). "Compensation for Technical Professionals in the Knowledge Age", *Research Technology Management*, (September - October): 49-56.

Dibella, A. Nevus, E. and Gould, J. (1996). "Understanding Organisational Learning Capability". *Journal of Management Studies*. May (3): 361-379.

Doolin, B. (1996). "Alternative Views of Case Research in Information Systems", *Australian Journal of Information Systems*, (3): 21-29.

Douglas, M. (1986). *How Institutions Think*. Syracuse University Press, Syracuse, NY.

Drucker, P. (1969). *The Age of Discontinuity: Guidelines to Our Changing Society*. Heinenmann, London.

---. (1988). "The Coming of the New Organization", *Harvard Business Review*, (January-February): 45-53.

---. (1992). "The New Society of Organizations", *Harvard Business Review*, (September-October): 95-104.

---. (1993). *Post-Capitalist Society*. New York: Butterworth Heineman.

Earl, M. (1997). "Knowledge as Strategy", in *Knowledge in Organizations*. L. Prusak (eds). 1-16. Butterworth-Heinemann, Boston, USA.

Easton, G. (1995). "Methodology and Industrial Networks", in *Business Marketing*. D. Wilson and K. Moller (eds). Kluwer Academic Publishers, Norwell,

USA.

Eccles, R. (1991). "The Performance Measurement Manifesto", *Harvard Business Review*, (January-February): 131-37.

Eisehardt, K. M. (1989). "Making Fast Strategic Decisions in High-Velocity Environments", *Academy of Management Journal* 32(3): 543-76.

Ellis, S. (1998). "Buckman Learning Center", *Journal of Knowledge Management*, March, 1(3): 189-196.

Ellram, L. (1996). "The Use of the Case Study Method in Logistics Research", *Journal of Business Logistics* 17(2): 93-138.

Fahey, L., and V. K. Naraynan. (1986). "Organizational Beliefs and Strategic Adaptation", *Proceedings of the National Academy of Management*, 7-11. Chicago, IL.

Faulkner, W. Senker. J., and L. Velho. (1995). *Knowledge Frontiers: Public Sector Research and Industrial Innovation in Biotechnology in Biotechnology, Engineering Ceramics, and Parallel Computing*. Oxford University Press, Oxford.

Fenton, E. (1996). "*Strategic Agenda Building and Change in the Water Industry*", Unpublished Phd Thesis University of Warwick.

Finerty, L. (1997). "Information retrieval for Intranets: The case of knowledge management", *Documenet World*, 2(5): 32-34.

Fiol, C. M., and A. S. Huff. (1992). "Maps for Managers: Where Are We? Where Do We Go From Here?", *Journal of Management Studies*, 29(3): 267-86.

Fiol, M., and M. Lyles. (1985). "Organizational Learning", *Academy of Management Review*, 10(4): 803-13.

Fiske, S., and S. Taylor. (1991). *Social Cognition*. McGraw-Hill Inc. New York.

Foss, N. (1996). "Knowledge-Based Approaches to The Theory of the Firm: Some Critical Comments", *Organization Science*, 7(5) (September-October): 470-76.

Fox, W. (1995). "Sociotechnical System Principles and Guidelines: Past and Present", *Journal of Applied Behavioural Science*, 31(1) (March): 91-105.

Fransman, M. (1994). "Information, Knowledge, Vision and Theories of the Firm", *Industrial and Corporate Change*, 3(3): 713-57.

Fruinn, W. M. (1997). *Knowledge Works: Managing Intellectual Capital at Toshiba*. Oxford University Press, Oxford.

Fukuyama, F. (1995). *Trust: The Social Values and the Creation of Prosperity*. Hamish Hamilton, London.

Galbraith, J. R. (1977). *Organization Design*. Addison-Wesley, Reading, Massachusetts:

Galegher, J. *et al* (1990). eds. *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*. LEA, London.

Galliers, R. (1992). ed. *Information Systems Research: Issues, Methods and Practical Guidelines*. Blackwell Scientific, Oxford.

Garvin, D. (1993). "Building A Learning Organization", *Harvard Business Review*, 71(4) (July/August): 78-91.

Gibbons *et al.* (1994). *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. Sage Publications, London.

Giddens, A. (1979). Central Problems in Social Theory. Macmillan, London.

---. (1984). *The Constitution of Society*. Polity Press, Cambridge.

Gioia, D., and E Pitre. (1990). "Multiparadigm Perspectives on Theory Building", *Academy of Management Review*, 15(4): 584-602.

Glaser, B. G. (1978). *Theoretical Sensitivity: Advances in the Methodology of Grounded Theory*. Sociology Press, Mill Valley, CA.

Glaser , B. G., and A. Strauss. (1967). *The Discovery of Grounded Theory of Structure*. Aldine Publishing Co, Chicago, IL.

Glazer, R. (1998). "Measuring the Knower: Towards a Theory of Knowledge Equity", *California Management Review*, Spring, 40(3): 175-94.

Graham, A. and Pizzo V. (1996). "A Question of Balance: Case Studies in Strategic Knowledge Management", *European Management Journal* 14(4) (August): 338-46.

Grant, R. (1991). "The Resource-based theory of Competitive Advantage: Implications for Strategy Formulation". *California Management Review*, 33(3): 114-135.

---. (1996). "Toward a Knowledge-Based Theory of the Firm", *Strategic Management Journal*, Winter, (17): 109-22.

---. (1997). "The Knowledge-Based View of the Firm: Implications for

Management Practice", *Long Range Planning* 30(3): 450-54.

Gregerman, I. B. (1981). *Knowledge Worker Productivity*. New York: AMA Management Briefing, American Management Association.

Grint, K., and S. Woolgar. (1997). *The Machine at Work: Technology, Work and Organization*. Polity Press, UK.

Grudin, J. (1988). "Why Groupware Application Fail: Problems in Design and Evaluation", *Office Technology People* 4(3): 245-64.

Hall, R. (1994). "Intangible Sources of Sustainable Competitive Advantage", In *Competence Based Competition*. G. Hamel and A. Heene (eds). 149-169. Wiley, Chicester, UK.

Hamel, G. (1991). "Competition for Competence and Inter-partner Learning Within International Strategic Alliances", *Strategic Management Journal*, (12): 83-103.

Hamel, G., and S. Prahalad. (1990). "The Core Competence of the Corporations", *Harvard Business Review*, (May-June): 79-91.

Handy, C. (1989). *The Age of Unreason*. Arrow. London.

---. (1994). *The Empty Raincoat*. Hutchinson, London.

Hansen, M. (1999). "The Search-Transfer Problem: the Role of Weak Ties in Sharing Knowledge Across Organization Sub-units", *Administrative Science Quarterly*, (44): 82-111.

Hanssen-Bauer, J. and C. C. Snow. (1996). "Responding to hypercompetition: the structure and processes of a regional learning network organization". *Organization Science*, 7(4): 413-437.

Hargadon, A., and R. Sutton. (1997). "Technology Brokering and Innovation in a Product Development Firm", *Administrative Science Quarterly*, (42): 716-49.

Hari Das, T. (1983). "Qualitative Research in Organizational Behaviour", *Journal of Management Studies*, 20(3): 301-14.

Harvey, L., and M. D. Myers. (1995). "Scholarship and Practice: the Contribution of Ethnographic Research Methods to Bridging the Gap", *Information Technology and People*, 8(3): 13-27.

Hayek, F. A. (1945). "The Use of Knowledge in Society", *The American Economic Review*, 35(4) (September): 519-30.

Hedberg, B. (1981). "How Organizations Learn and Unlearn", in *Handbook of Organization Behaviour*. P. C. Starbuck W. and H Nystrom (eds). Vol. 1. 3-27. Oxford University Press, New York.

Heilbruner, C. (1976). *Business Civilization in Decline*. Norton, New York, NY.

Hempill, J. K. (1959). "Job Descriptions for Executives", *Harvard Business Review*, 37(5).

Heraty, N., and M. Morley. (1999). "A Review of Issues in Conducting Organization-Level Research With Reference to the Learning Organization", *The Learning Organization*, 2(4): 27-35.

Hickson *et al.* (1969). "Operations Technology and Organizations Structure: An Empirical Reappraisal", *Administrative Science Quarterly*, (14): 378-97.

Hislop, D. (1999). "The Movex Project: Knowledge Management at

BrightCo" in *Case Studies in Knowledge Management*, Scarbrough, H. and Swan, J. (eds). 51-58. Institute of Personnel Development, London. UK.

Hislop, D.. *et al.* (1998). "The Tangled Web of Innovation", Stretching the Boundaries of Organisation Studies into the Next Millennium. Maastricht University.

Hoffman, K., and P. Senge. (1993). "Communities of Commitment: The Heart of Learning Organization", *Organizational Dynamics*, (Autumn): 4-23.

Howitt, P. (1998). "On Some Problems in Measuring Knowledge-Based Growth", in *The Knowledge Economy*. Dale Neef (eds). 97-117. Butterworth-Heinemann, Boston.

Huber, G. (1984). "The Nature and Design of Post-Industrial Organizations", *Management Science*, 30(8)(August): 928-951.

---. (1991). "Organizational Learning: The Contributing Processes and the Literatures", *Organization Science*, 2(1) (February): 88-116.

Huber, G. P., and D. J. Power. (1985). "Retrospective Reports of Strategic-Level Managers: Guidelines for Increasing Their Accuracy", *Strategic Management Journal*, 6(2): 171-80.

Ives, M. *et al.* (1998). "Knowledge Management Is an Emerging Area with a Long History", Andersen Consulting Web-Site.

Jarvenpaa, S. K. Knoll, and D. Leidner. (1998). "Is Anybody Out There? Trust in Global Virtual Teams". *Journal of Management Information Systems*. 14(4): 29-64.

Jick, T. (1979). "Mixing Qualitative and Quantitative Methods: Triangulation in Action", *Administrative Science Quarterly*, (24) (December): 602-

11.

Johnson, M. K., and L. Hasher. (1987). "Human Learning and Memory", *Annual Review of Psychology*, (38): 631-68.

Johnson, G. (1992). "Manageing strategic change – Strategy, culture and action". *Long Range Planning*. 25(1): 28-36

Junnarker, B. and Brown, C. V. (1997) "Re-assessing the enabling role of IT in knowledge management". *Journal of Knowledge Management*. 1(2): 10-14.

Kaplan, B., and D. Duchon. (1988). "Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study", *MIS Quarterly* 12(4): 571-87.

Kaplan, B., and J. A. Maxwell. (1994). "Qualitative Research Methods for Evaluating Computer Information Systems", in *Evaluating Health Care Information Systems: Methods and Applications*. C. E. Aydin J. G. Anderson and S. J. Jay (eds). Sage, Thousand Oaks, CA.

Kaplan, R., and D. Norton. (1992). "The Balanced Scoreboard - Measures That Drive Performance", *Harvard Business Review*, (January-February):71-79.

Keegan, A. (1998). "Management Practice in Knowledge-Intensive Firms: The Future of HRM in the Knowledge Era", *Presented at British Academy of Management Conference* Nottingham, September.

Klavans, R. (1994). "The Measurement of a Competitor's Core Competence", *Competence Based Competition*. G. Hamel and A. Heene (eds). 171-182. Wiley, Chicester.

Kock *et al.* (1996). "Learning and Process Improvement in Knowledge Organisations: a Critical Analysis of Four Contemporary Myths", *The Learning Organization* 3(1): 31-41.

Kogut, B., and U Zander. (1992). "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology", *Organization Science*, (3): 383-97.

---. (1993). "Knowledge of the Firm and Evolutionary Theory of the Replication of Technology", *Journal of International Business Studies*, 24(4): 625-45.

---. (1995). "Knowledge, Market Failure and the Multinational Enterprise: a Reply", *Journal of International Business Studies*, (Second Quarter): 417-26.

Kumar, K. (1995). *From Post-Industrial to Post-Modern Society.* Blackwell, London.

Lam, A. (1997). "Embedded Firms, Embedded Knowledge: Problems of Collaboration and Knowledge Transfer in Global Cooperative Ventures", *Organization Studies*, 18(6): 973-96.

Landry, M., and C. Banvile. (1992). "A Disciplined Methodological Pluralism for MIS Research", *Accounting, Management and Information Technologies*, 2(2): 77-97.

Lane, R. (1966). "The Decline of Politics and Ideology in a Knowledgeable Society". *American Sociological Review.* 31(649-662).

Langfield-Smith, K. (1992). "Exploring the Need for a Cognitive Map", *Journal of Management Studies*, 29 (1992): 349-68.

Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Open University Press, Milton Keynes.

---. (1993). *We Have Never Been Modern*. Harvester Wheatsheaf, Hamel Hempsted, England.

Layton, E. (1976). "American Ideologies of Science and Technology". *Technology and Culture*. 17: 688-701.

Lave, J. and E. Wenger, (1990). *Situated learning: Legitimate Peripheral Participation*. Institute for Research on Learning Palo Alto, CA, 1990.

Lee, A. S. (1991). "Intergrating Positivist and Interpretive Approaches to Organizational Research", *Organization Science*, (2): 342-65.

---. (1994). "Electronic Mail As a Medium for Rich Communication: an Empirical Investigation Using Hermeneutic Interpretation", *MIS Quarterly*, 18(2): 143-57.

Leidner, D. E. (1999). "Information Technology and Organizational Culture". in Galliers, R. D. , Leidner, D. E., Baker, B.S.H. (eds). *Strategic Information Management*. 2nd edition. Butterworth Heinemann: Oxford. pp. 523-550.

Leonard-Barton, D. (1992). "The Factory as a Learning Laboratory", *Sloan Management Review*, (Fall): 23-38.

---. (1995). *Wellsprings of Innovation*. Harvard Business School Press, Boston, MA.

Leonard, D., and S. Sensiper. (1998). "The Role of Tacit Knowledge in Group Innovation", *California Management Review*, Spring, 40(3): 112-32.

Levinthal, D. (1991). "Organizational Adaptation and Environmental Selection--Interrelated Processes of Change", *Organization Science*, 2(1) (February): 140-45.

Levinthal, D., and J. March. (1993). "The Myopia of Learning", *Strategic Management Journal*, Winter, (14): 95-112.

Levy, S. (1988). "Information Technologies in Universities: An Institutional Case Study". Unpublished doctoral dissertation. Northern Arizona University.

Li, F. (1997). "From Compromise to Harmony: Organizational Re-Design Through Information and Communication Technologies", *International Journal of Information Management*, 17(6): 451-64.

Liedtka, J. (1999). "Linking Competitive Advantage with Communities of Practice", *Journal of Management Inquiry*, 8(1) (March): 5-16.

Lincoln, Y., and E. Guba. (1985). *Naturalistic Inquiry*. Beveley Hills, CA.

Lindkvist, L. (1996). "Performance Based Compensation in Healthcare - A Swedish Experience", *Financial Accountability & Management*, 12(2): 9-105.

Lowendahl, B. (1997). *Strategic Management of Professional Service Firms*. Handelshojskolens Forlag, Copenhagen.

Luthans, F., and T. R. Davis, (1982). "An Idiographic Approach to Organizational Behaviour Research", *Academy of Management Review* 7(3): 380-91.

Lyles, M. A. (1988). "Learning Among Joint Ventures Sophisticated Firms", *Management International Review*, (28): 85-98.

Lyles, M., and C. Schwenk. (1992). "Top Management, Strategy and Organizational Knowledge Structures", *Journal of Management Studies*, 29(2): 155-74.

Lynch, L. M. (1994). "Introduction". In *Training and the Private Sector: International Comparisons*. L. M. Lynch (eds). University of Chicago Press, Chicago.

March, J. G., and H. A. Simon. (1958). *Organizations*. Wiley, New York. 1958.

Markus, L. (1990). "Towards a "Critical Mass" Theory of Interactive Media", *Organizational Communication Technology*. J. Fulk and Steinfield. C. (eds). 194-218. Sage Publication, London.

Markus, L., and Robey. D. (1988). "Information Technology and Organizational Change: Causal Structure in Theory and Research", *Management Science*, 34(5)(May): 583-98.

Matusik, S., and C. Hill. (1998). "The Utilization of Contingent Work, Knowledge Creation, and Competitive Advantage", *Academy of Management Review*, 23(4): 680-97.

McConnell, D. (1994). *Implementing Computer Supported Cooperative Learning*. Kogan Page, London.

McDermott, R. (1999). "Why Information Technology Inspired But Cannot Deliver Knowledge Management", *California Management Review*, Summer, 41(3):103-117.

McDonell, E. (1995). "Building a Global Virtual Community for Information Gathering and Technology Transfer", *Journal of the Association for Global Strategic Information*, March. 4(1): 10-17.

McGill, M., and J. Slocum. (1993). "Unlearning the Organization", *Organizational Dynamics*, Autumn, 22(2): 67-78.

McLoughlin, I. (1999). *Creative Technological Change: The Shaping of Technology and Organisations*. Routledge, London and New York.

Meister, J. (1998). *Corporate Universities: Lessons in Building a World-Class Wwork Force*. McGraw-Hill, USA.

Myers, M. D. (1994). "A Disaster for Everyone to See: An Interpretive Analysis of a Failed IS Project", *Accounting, Management and Information Technologies* 4(4): 185-201.

---. (1995). "Dialectical Hermeneutics: a Theoretical Framework for the Implementation of Information Systems", *Information Systems Journal*, 5(1): 51-70.

---. 1997. "Qualitative Research in Information Systems". *MIS Quarterly*, (June): 241-42.

Miles, M. B., and Huberman. A. M. (1994). *Qualitative Data Analysis: A Sourcebook of New Methods*. Sage, Thousand Oaks, CA.

Miles, G., R. Miles, V. Perrone, and Edvinsson, L. (1998). "Some Conceptual and Research Barriers to the Utlisation of Knowledge". California Management Review. 40(3): 281-286.

Miller-Hosley *et al.* (1994). "The Quest for the Competitive Learning Organization", *Management Decision* 32(6): 5-15.

Miller, R., and G. Wurzburg. (1998). "*Investing in Human Capital*", The Knowledge Economy. D. Neef (eds). Boston: Butterworth-Heinemann, 1998.

Mintzberg, H. (1979). "Patterns In Strategy Formation", *Management Science*, 24(9)(May): 934-48.

Moenaert, S. F., and W. E. Souder. (1990). "An Information Transfer Model for Integrating Marketing and R&D Personnel in New Product Development Projects", *Journal of Product Innovation Management*, 7(2): 91-107.

Monteiro, E., and O. Hanseth. (1996). "Social Shaping of Information Infrastructure: On Being Specific about the Technology", in *Information Technology and Changes in Organizational Work*. W. Walsham G. Jones M. Orlikowski and J. Degross (eds). Chapman & Hall, London. 1996. 325-243.

Moorman *et al.* (1992). "Relationships Between Providers and Users of Market Research: The Dynamics of Trust Within and Between Organizations", *Journal of Marketing Research*, (29)(August): 314-28.

Morgan, G. (1986). *Images of Organization*. Sage, Beverly Hills, CA.

Morgan, G., and Smircich. (1980). "The Case for Qualitative Research", *Academy of Management Review*, 5(4): 491-500.

Mumford, E. (1999). "Routinisation, Re-Engineering, and Socio-Technical Design: Changing Ideas on the Organisation of Work", *Rethinking Management Information Systems*. W. Currie and B. Galliers (eds). 28-44. Oxford: Oxford University.

Nahapiet, J., and S. Ghoshal. (1998). "Social Capital, Intellectual Capital, and the Organizational Advantage", *Academy of Management Review*. (23)(2): 242-66.

Neef, D. eds (1998). *The Knowledge Economy*. Boston: Butterworth-Heinemann, Boston.

Neilson, R. (1997). *Collaborative Technologies & Organizational Learning*. Idea Group Publishing, USA.

Nelson, K., and J. Cooprider. (1996). "The Contribution of Shared Knowledge to IS Group Performance", *Management Information Systems Quarterly*, (December): 409-429.

Nelson, R., and S. Winter. (1982). *An Evolutionary Theory of Economic Change*. Belknap Press, Cambridge.

Neuman, W. L. (1991). *Social Researcher Methods: Qualitative and Quantitative Approaches*. Boston: Alln and Bacon, Boston.

Newell, S. Swan, J. and Preston, J. (1998). "Trust and inter-organisational networking". Paper presented at the 13th Egos colloquim, Mastricht, July.

Newell, S. (1999). "Ebank: a failed knowledge management initiative", in *Case Studies in Knowledge Management*, Scarbrough, H. and Swan, J. (eds). 24-34. Institute of Personnel Development, London. UK.

Newman, V. (1997). "Redefining Knowledge Management to Deliver Competitive Advantage", *Journal of Knowledge Management*, 1(2): 123-28.

Nevis, E. DiBella A., and J. Gould. (1995). "Understanding Organizations As Learning Systems", *Sloan Management Review*, (Winter): 73-95.

Nicolini, D., and M. Mezanar. (1995). "The Social Construction of Organizational Learning: Conceptual and Practical Issues in the Field", *Human Relations* 48(7): 727-46.

Nomikos, G. E. (1989). "Managing Knowledge Workers for Productivity", *National Productivity Review*, 8(2): 165-74.

Nonaka, I. (1991). "The Knowledge-Creating Company", *Harvard Business Review*, (November-December): 96-104.

---. (1994). "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science*, (5): 14-37.

---. (1998). "The Concept of 'Ba': Building a Foundation for Knowledge Creation", *California Management Review*, Spring, 40(3): 40-54.

Nonaka, I., and H Takeuchi. (1995). *The Knowledge Creating Company*. Oxford University Press, New York, NY.

Oakland, J., and A. S. Sohal. (1987). "Production Management Techniques in UK Manufacturing Industry: Usage and Barriers", *International Journal of Operations and Production Management*, 7(1): 8-37.

OECD. (1981). *Information Activities, Electronics, and Telecommunications. Technologies: Impact on Employment, Growth and Trade.* Organization for Economic Development, Paris.

OECD Report. (1996). Vol. 1 Highlights ed. 13. Paris: OECD, 1996.

Offsey, S. (1997). "Knowledge Management: Linking People to Knowledge for Bottom Line Results", *Journal of Knowledge Management*, 1(2): 113-22.

Orlikowski, W. (1992). "The Duality of Technology: Rethinking the Concept of Technology in Organizations", *Organization Science*, 3(3): 398-427.

---. (1996). "Evolving With Notes: Organizational Change Around Groupware Technology", in *Groupware and Teamwork: Invisible Aid or Technical Hindrance*. 23-60. C. Ciborra (eds). John Wiley & Sons, Chicheter, UK.

Orlikowski *et al.* (1996). *Information Technology and Changes in Organizational Work.* Chapman & Hall, UK.

Orlikowski, W. J., and J. Baroudi. (1991). "Studying Information Technology in Organisations: Research Approaches and Assumptions", *Information Systems Research*, 2(1): 1-28.

Orlikowski, W., and D. Gash. (1994). "Technological Frames: Making Sense of Information Technology in Organizations", *ACM Transaction on Information Systems*, April. 12(2): 174-207.

Orlikowski, W., and D. Robey. (1991). "Information Technology and the Structuring of Organizations", *Information Systems Research*, 2(2): 143-69.

Orr, J. (1990). "Sharing Knowledge, Celebrating Identity: War Stories and Community Memory in a Service Culture", in *Collective Remembering: Memory in Society.* D. S. Middleton and D. Edwards (eds). Sage Publications, Beverly Hills, CA.

Pandit, N. (1996). "The Creation of Theory: A Recent Application of the Grounded Theory Method", *The Qualitative Report*, 2(4).

Pasmore *et al.,* (1982). "Sociotechnical Systems: A North American Reflection on Empirical Studies of the Seventies", *Human Relations* 35.12 (1982): 1179-204.

Patton, M. (1990). *Qualitative Evaluation and Research Methods.* Newbury Park, Sage.

Pava, C. (1986). "Redesigning Sociotechnical Systems Design: Concepts and Methods for the 1990s", *The Journal of Applied Behavioural Science*, 22(3): 201-21.

Penrose, E. (1959). *The Theory of the Growth of the Firm.* Wiley, New York.

Pentland, B. T. (1995). "Information Systems and Organization Learning: The Social Epistemology of Organizational Knowledge Systems", *Accounting, Management and Information Technologies*, 5(1): 1-21.

Pepper, S. (1942). *World Hypothese.* University of California Press, Berkeley, CA.

Peters, T. (1993). "Thriving Chaos", *Working Woman*, September. 18(9): 42-45.

Pettigrew, A. (1992). "The Character and Significance of Strategy Process Research", *Strategic Management Journal*, 13(Special Issue): 5-16.

---. (1993). "Managing the Twin Processes of Competition and Change: The Role of Intangible Assets", in *Implementing Strategic Processes - Change, Learning and Cooperation.* B Chakravarthy J Roos A van der Ven P Lorange (eds). 3-42. Blackwell, Oxford.

---. "What Is a Processual Analysis", *Scandinavian Journal of Management* 13.14 (1997): 337-248.

Pettigrew, A. M., and R. Whipp. (1991). *Managing Change for Competitiveness Success.* Basil Blackwell, Oxford.

Philips, E. and D. Pugh. (1994). *How to get a Phd. Buckingham.* Open University Press

Pisano, G. (1994). "Knowledge, Integration, and the Locus of Learning: An Empirical Analysis of Process Development", *Strategic Management Journal*, 15: 85-100.

Polanyi, M. (1958). *Personal Knowledge: Toward a Post-Critical Philosophy*. University of Chicago Press, Chicago, IL.

Polanyi, M. (1962). *Personal Knowledge: Towards a Post Critical Philosophy*. London: Routledge, London.

---. (1966). *The Tacit Dimension*. Anchor, Garden City, NY.

Porat, M. U. (1977). *The Information Economy: Definition and Measurement*. Office of Telecommunications, US Department of Commerce, Washington DC.

Postman, N. (1993). *Technopoly: The Surrender of Culture to Technology*. Vintage/Random House, New York, NY.

Prahalad, C. K., and R. A. Bettis. (1986). "The Dominant Logic: A New Linkage Between Diversity and Performance" *Strategic Management Journal*, (7): 485-501.

Prahalad, C. K., and G. Hamel. (1990). "The Core Competence of the Corporation", *Harvard Business Review*, (82)(May-June): 79-91.

Quinn, J. B. (1992). *Intelligent Enterprise: A Knowledge and Service Based Paradigm for Industry*. Free Press, New York, NY.

Quintas *et al.*,(1997). "Knowledge Management: A Strategic Agenda", *Long Range Planning*, 30(3): 385-91.

Raelin, J. (1993). "Cross-Cultural Implications of Professional/Management Conflict", *Journal of General Management*, Spring, 17(3): 16-30.

Reger, R., and A. Huff. (1993). "Strategic Groups: a Cognitive

Perspective", *Strategic Management Journal*, (14): 103-24.

Reich, R. (1991). *The Work of Nations: Preparing ourself for the 21st Century Capitalism.* Konopf, New York.

Richardson-Klavehn, A., and R. A. Bjork. (1988). "Measures of Memory", *Annual Review of Psychology*, (39): 475-543.

Robertson, M. (1999). "Expert Consulting: a Case of Managed Autonomy". in *Case Studies in Knowledge Management*, Scarbrough, H. and Swan, J. (eds). 13-23. Institute of Personnel Development, London. UK.

Robson, C. (1993). *Real World Research: A Resource for Social Scientists and Practitioners-Researchers.* Oxford: Blackwell, Oxford.

Roos, G., and J. Roos. (1997). "Measuring Your Company's Intellectual Performance", *Long Range Planning*, 30(3): 413-26.

Rotler, J. B. (1980). "Interpersonal Trust, Trustworthiness, and Gullibility", *American Psychologist,* 35(1): 1-7.

Ruggles, R. L., (1997). "Tools for Knowledge Management *Knowledge*", in *Management Tools, Resources for the Knowledge-Based Economy.* R. L. Ruggles (eds). 8 pages. Butterworth-Heinemann, Boston, MA.

Sanchez, R. A. A. Heene,. and H. Thomas. (1996). *Dynamic of Competence-Based Competition: Theory and Practice in the New Strategic Management.* Elservier, Oxfoxd.

Sanchez, R. and Heene A., (1997). *Strategic Learning and Knowledge Management.* John Wiley & Sons, Chichester, New York.

Sandelands, L., and K. Stablein. (1987). "The Concept of an

Organization Mind", in *Research in the Sociology of Organizations*. eds N. Bachaarach, S. Ditomaso (eds). JAI Press, San Francisco.

Sarvary, M. (1999). "Knowledge Management and Competition in the Consulting Industry", *California Management Review*, 41(2): 95-107.

Scarbrough, H. (1995). "Blackboxes, Hostages and Prisoners", *Organizational Studies,* 16(6): 991-1019.

---. (1995). "The Socio Engagement of Social Science: A Tavistock Anthology. 1993. II: 695", *Human Relations*, 48(1): 23-33.

---. (1996). *The Management of Expertise*. Macmillan, London, UK.

---. (1997). "Making the Matrix Matter: The Social Construction of Strategic Information Systems", *Journal of Management Studies*, 34(2): 1-20.

---. (1998). "Path(Ological) Dependency? 'Core Competencies' From an Organisational Perspective", *British Journal of Management*, (9): 219-32.

---. (1999a). "Knowledge as Work: Conflicts in the Management of Knowledge Workers", *Technology Analysis & Strategic Management*, 11(1): 5-16.

---. (1999b). "Conclusion: The concept of Knowledge Management", in *Case Studies in Knowledge Management*, Scarbrough, H. and Swan, J. (eds). 85-93. Institute of Personnel Development, London. UK.

Scarbrough, H. and Swan, J. (1999). *Case Studies in Knowledge Management*, Institute of Personnel Development, London. UK.

Scarbrough, H. Swan J. A. and J. Preston. (1999). *Knowledge Management: a Literature Review*. Institute of Personnel and Development, London. UK.

Schein, E. (1993). "How Can Organizations Learn Faster? The Challenge of Entering the Green Room", *Sloan Management Review,* (Winter): 85-92.

---. (1985). *Organizational Culture and Leadership*, Jossey-Bass, San Francisco, CA.

---. (1988). *Process Consultation Volume: Its Role in Organization Development.* Addison-Wesley, Reading, MA.

Schutz, A. (1962). *Collected Paper I: The Problem of Social Reality.* Martinus Nijhoff, Hague, Nethelands.

Schwenk, C. (1988). "The Cognitive Perspective in Strategic Decision Making", *Journal of Management Studies*, (25): 41-56.

Senge, P. M. (1990). *The Fifth Discipline.* Doubleday, New York.

Senker, J. (1995). "Tacit Knowledge and Models of Innovation", *Industrial and Corporate Change* (4): 425-47.

Shaffir *et al.* (1980). *Fieldwork Experience: Qualitative Approaches to Social Research.* St. Martin, New York.

Shani, A. Sena J. (1994). "Information Technology and the Integration of Change: Sociotechnical System Approach", *Journal of Behavioural Science* 30(2) (June): 247-70.

Shannon, C. E., and W. Weaver. (1949). The Mathematical Theory of Communication. University of Illinois Press, Urbana, IL.

Silver, M. (1991). *Competent to Manage: Approaches to Management Training and Development.* Routledge, London, UK.

Silverman, D. (1993). *Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction.* Sage, London.

Sivula *et al.* (1997). "Competence Building by Incorporating Clients into the Development of a Business Service Firm's Knowledge Base", in *Strategic Learning and Knowledge Management.* R. Sanchez and A. Heene (eds). 121-138. John Wiley & Sons Ltd, England.

Skyrme, D. J. amd D. Amidon. (1997*). Creating the Knowledge-based Business*, Business Intelligence Limited, London.

Snow, C. C., and J. B. Thomas. (1994). "Field Research Methods in Strategic Management: Contribution to Theory Building and Testing", *Journal of Management Studies*, 31(4): 457-79.

Snow, D. A., and L. Anderson. (1991). "Researching the Homeless: The Characteristics Features and Virtues of the Case Study", *A Case for Case Study*. (eds) A. Orum & G. Sjoberg J. Feagin. 148-173. Chapel Hill, NC: University of North Carolina Press, Chapel Hill, NC.

Spender, J-C. (1996). "Making Knowledge the Basis of A Dynamic Theory of the Firm", *Strategic Management Journal*, Winter Special Issue, (17): 45-62.

---. (1998). "Pluralist Epistemology and the Knowledge-Based Theory f the Firm", *Organization*, 5(2): 233-56.

Spender, J-C., and R. Grant. (1996). "Knowledge and the Firm: Overview", *Strategic Management Journal*, 17(Winter Special Issue): 5-9.

Stake, R. (1995). *The Art of Case Study Research.* Sage Publication, London.

Starbuck, W. (1992). "Learning by Knowledge-Intensive Firms", *Journal of Management Studies*, 29(6) (November): 713-40.

---. (1993). "Keeping Butterfly and an Elephant in a House of Cards: The Elements of Exceptional Success", *Journal of Management Success* 30(6): 885-921.

Stehr, N. (1994). *Knowledge Societies*. Sage publications, London.

Stein, E. (1995). "Organizational Memory: Review of Concepts and Recommendations for Management", *International Journal of Information Management* 15(2): 17-32.

Stein, E. W., and V. Zwass. (1995). "Actualising Organizational Memory of Information Systems", *Information System Research*, (6): 85-117.

Steinfield, C. W. (1986). "Computer Mediated Communication in an Organizational Setting: Expanding Task-Related and Socioemotional Uses", in *Communication Yearbook 9*. M. L. McLaughlin (eds). 777-804. Sage, Beverly Hills, CA.

Stern, D. (1998). "*Human Resource Development in the Knowledge-Based Economy: Roles of Firms, Schools, and Governments*", The Knowledge Economy. D. Neef (eds). Butterworth-Heinemann, Boston.

Stern, D., and J. M. M. Ritzen (1991). *Market Failure in Training? New Economic Analysis and Evidence on Training of Adult Employees*. Springer-Verlag, Berlin and New York.

Stewart, T. (1997). *Intellectual Capital: The New Wealth of Organizations*. Nicholas Brealey Publishing, London.

Stinchcombe, A. (1990). *Information and Organizations*. Los Angeles:

University of California Press, Los Angeles.

Strauss, A. (1987). *Qualitative Analysis for Social Scientists.* Cambridge University Press, New York.

Strauss, A., and J. Corbin. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques.* London: Sage Publications, 1990.

Susman, G., and R. Chase. (1986). "A Sociotechnical Analysis of the Integrated Factory", *The Applied Behavioural Science*, 22(3): 257-70.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets.* Berrett-Koehler, San Francisco.

Sveiby, K-E, and T. Lloyd. (1987). *Managing Know-How: Add Value by Valuing Creativity.* Bloomsbury, London.

Swan, J. (1999). "Introduction: The concept of Knowledge Management", in *Case Studies in Knowledge Management*, Scarbrough, H. and Swan, J. (eds). 1-12. Institute of Personnel Development, London. UK.

Swan, J., and S. Newell. (1998). "Making Sense of Technological Innovation: The Political and Social Dynamic Cognition", in Managerial and Organization Cognition: Theory, Method and Research. C. Eden and J-C. Spender (eds). 108-128. Sage Publications, London.

Swieringa, J., and A. Wierdsma. (1992). *Becoming a Learning Organization.* Addison-Wesley, Workingham.

Taylor, S., and R. Bogdan. (1984). *Introduction to Qualitative Research Methods.* John Wiley & Sons, New York.

Teece, D. (1998). "Capturing Value From Knowledge Assets: The New

Economy, Markets For Know-How, and Intangibles Assets", *California Management Review*, Spring, 40(3): 55-79.

Teece, D. J. Pisano G. and Shuen A. (1994). "Firm Capabilities, Resources and the Concept of Strategy", Working Paper. University of California at Berkeley.

Tellis, W. (1997). "Application of a Case Study Methodology", *The Qualitative Report*, 3(3).

Tenkasi, R., and Boland. R. (1996). "Exploring Knowledge Diversity in Knowledge Intensive Firms: a New Role for Information Systems", *Journal of Organization Change* 9(1): 79-91.

Tjaden, G. (1996). "Measuring the Information Age Business", *Technology Analysis & Strategic Management*, 8(3): 233-46.

Toffler, A. (1970). *Future Shock*. Bantam Books, New York.

---. (1981). *The Third Wave*. Bantam Books, New York.

---. (1990). *Powershift: Knowledge, Wealth and Violence at the Edge of the 21st Century*. Bantam Books, New York, NY.

Trist, E. L. (1982). "The Sociotechnical Perspective", in *Perspectives on Organization Design and Behaviour*. A. H. Van de Ven & W. F. Joyce (eds). Wiley, New York.

Trist, E. L., and K. Bamforth. (1951). "Some Social and Psychological Consequences of the Longwall Method of Coal-Getting", *Human Relations*, (4): 3-38.

Trompennars, F. (1995). *Riding the Waves of Culture. Understanding*

Cultural Diversity in Business. Nicholas Brealey, London.

Tsoukas, H. (1993). "Analogical Reasoning and Knowledge Generation in Organization Theory", *Organization Studies* 14(3): 323-46.

---. (1994). "Refining Common Sense: Types of Knowledge in Management Studies", *Journal of Management Studies*, 31(6): 763-80.

---. (1996). "The Firm As A Distributed Knowledge System: A Constructionist Approach", *Strategic Management Journal*, Winter Special Issue, (17)): 11-25.

Van Maanen, J. (1979). "Reclaiming Qualitative Methods for Organizational Research: A Preface", *Administrative Science Quarterly*, 24: 520-26.

Varela, F. J. (1992). "Whence Perceptual Meaning? A Cartography of Current Ideas", in Understanding Origins: Contemporary Views on the Origin of Life, Mind, and Society. F. J. Varela and J. P. Dupuy(eds). 235-264. Dordrecht: Kluwer.

von Krogh, G. Roos J., and K. Slocum. (1994). "An Essay on Corporate Epistemology", *Strategic Management Journal*, Winter, (15): 53-71.

von Krogh, G., and J. Roos. (1995). "A Perspective on Knowledge Competence and Strategy", *Personnel Review*, 24(3): 56-76.

von Tunzelmann, G. N. (1995). *Technology and Industrial Progress*. Edward Elgar, Aldershot.

Waddel, C., and A. Sohal. (1998). "Resistance: a Constructive Tool for Change Management", *Management Decision*, 36(8): 543-48.

Wainwright, D. (1997). "Can Sociological Research Be Qualitative, Critical and Valid", *The Qualitative Report*, July, 3(2).

Walck, C. (1996). "Organizations as Places: a Metaphor for Change", *Journal of Organizational Change*, 9(6): 26-40.

Walsh, J. (1995). "Managerial and Organizational Cognition: Notes From a Trip Down Memory Lane", *Organization Science*, 6(3): 280-321.

Walsh, J., and G. Ungson. (1991). "Organizational Memory", *Academy of Management Review*, (16): 57-91.

Walsham, G. (1993). *Interpreting Information Systems in Organizations*. Chichester, John Wiley and Sons, UK.

---. (1995). "The Emergence of Interpretivism in IS Research", *Information Systems Research,* 6(4): 376-94.

Walsham, G., and T. Waema. (1994). "Information Systems Strategy and Implementation: A Case Study of a Building Society", *ACM Transactions on Information Systems,* 12(2) (April): 150-73.

Walton, R. E. (1985). "From Control to Commitment in the Workplace", *Harvard Business Review*, (March-April): 77-84.

Ward-Schofield, J. (1993). "Increasing the Generalisability of Qualitative Research", in *Social Research: Philosophy, Politics & Practice.* M. Hammerseley(eds). 200-25. Open University/Sage, London.

Ware, J. and Degoey P. (1998). "Knowledge Work and Information Technology", *Hass School of Business Working Paper* 98-WP-1028. (February): 1-36.

Watts, S. T. James., and J. Henderson. (1997). "Understanding Strategic Learning: Linking Organizational Learning, Sensemaking, and Knowledge Management", *Managerial and Organizational Cognition*, Academy of Management Meeting.

Webster, F. (1995). *Theories of the Information Society*. Routledge, London.

Weick, K. (1979). *The Social Psychology of Organizing*. McGraw-Hill, New York.

---. (1990). "Technology as Equivoque: Sense Making in New Technologies", in *Technology and Organizations*. P. S. Sproull L. S. and associates (eds). 1-44.

---. (1995). *Sensemaking in Organizations*. Sage. Newbury Park, CA.

Weick, K. and Roberts, K. (1993). "Collective Mind in Organizations: Heedful Interrelating on Flight Decks", *Administrative Science Quarterly*, (38): 357-81.

Wenger, E. (1991). "Communities of Practice: Where Learning Happens", *Benchmark*, (Fall): 82-84.

Yin, R. (1984). *Case Study Research: Design and Methods*. Sage, Beverly Hills, CA.

---. (1989). *Case Study Research: Design and Methods (Rev.ed)*. Sage, Beverly Hills, CA.

---. (1994). *Case Study Research: Design and Methods*. 2nd Editions, Sage, London.

Zack, M. (1999a). "Develop a Knowledge Strategy", *California Management Review*, Spring, 41(3): 124-45.

---. (1999b). "Managing Codified Knowledge", *Sloan Management Review*, (*Summer*): 45-58.

Zack, M., and J. McKenney. (1995). "Social Context and Interaction in On-Going Computer-Supported Management Groups", *Organization Science*, July-August, 6(4): 394-422.

Zuboff, S. (1988). *In the Age of the Smart Machine*. Basic Books, New York, NY.

Zucker, L. (1986). "Production of Trust: Institutional Sources of Economic Structure", in *Research in Organizational Behaviour*, 53-111. B. Staw and L. L. Cummings (eds). 53-111.